Do Value-Added Taxes Affect International Trade Flows? Evidence from 30 Years of Tax Reforms*

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Abstract

This paper uses all Value Added Tax (VAT) changes across all EU Member States from 1988 to 2016 to estimate the effect of VATs on trade flows. We find small elasticities of trade flows with respect to VATs, in spite of some of the VAT changes being substantial. Our estimates imply that trade flows respond much less to VATs than to tariffs. This finding holds across different time periods, countries and types of reforms. Our results imply that VATs are unlikely to distort trade flows.

JEL Classification: H87, H20, F32, F10
Keywords: value-added taxes, border tax adjustment, international trade

*We thank Pinelopi Goldberg, Jim Hines, Pau Pujolas and Joel Slemrod for helpful comments.

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1 Introduction

Value-Added Taxes (VATs) have become the most common form of consumption taxes in the world, rapidly replacing tariffs as well as sales and excise taxes, so much so that more than 80% of the world's countries have adopted a form of VAT. The academic consensus is that adjusting VATs at the border – by levying VATs on imports but exempting exports – does not distort trade flows as long as imported goods are subject to the same VAT rate as domestic goods. For this reason, VATs, as they are currently implemented, are considered to be trade neutral and the World Trade Organization (WTO) allows border adjustment of VATs, but does not allow border adjustment of direct taxes (i.e., payroll taxes, income taxes, etc.) or tariffs.

This consensus, however, has been repeatedly questioned by policy makers.[1] The trade neutrality of VAT adjustments has received a lot of attention during the most recent U.S. presidential elections, but the debate dates back to at least 1971, when the U.S. exempted exports from corporate income taxes on the basis that European countries are able to exempt their exports from VATs.[2] This legislation was challenged by the European Union (EU), and the WTO disagreed with the U.S. on the grounds that subsidies to direct taxes are not considered trade neutral.

In spite of the WTO's position on the trade neutrality of the border adjustment of indirect taxes, there is limited empirical evidence on this question. Grossman (1980) and Feldstein and Krugman (1990) provide theoretical arguments in favor of VATs' trade neutrality: they show that changes in VATs will be mitigated through changes in the exchange rate, leaving import and export

[1] When the differential treatment of direct and indirect taxes by the WTO was decided in 1970, a number of countries disagreed and argued that exempting indirect taxes is not trade neutral. See §8 of the *Report by the Working Party on Border Tax Adjustments* (available at `https://www.wto.org/gatt_docs/English/SULPDF/90840088.pdf`). The main reason put forward for allowing exemptions of indirect taxes was that these exemptions have been in place for twenty years and "had proved fairly adequate and easy to administer" and "no motive could be found to change them" (see §9).

[2] In 1971, the U.S. Congress legislated the creation of a new corporate entity called a Domestic International Sales Corporation (DISC), which was exempt from U.S. corporate taxes as long as most of its income was the result of exports.

flows unaffected. Their theory relies on plausible but also strong assumptions, disregarding a number of practical issues associated with the implementation and administration of VATs. First, VATs are often implemented as a substitute to taxes that are likely to distort trade balances, such as corporate, income or payroll taxes.[3] If VAT changes are offset by changes in distortionary taxes, international trade flows might be affected, as shown in Feldstein and Krugman (1990). Second, while exports should qualify for full VAT rebates, this does not often happen in practice due to administrative difficulties. Changes in VATs can therefore hinder exports (Chandra and Long (2013)). Finally, a key theoretical argument for the trade neutrality of VATs is that tax incentives are mitigated through changes in real exchange rates: an increase in VAT should generate an increase in the exchange rate of the domestic currency of equivalent magnitude. However, since 1999 many European countries share a uniform currency, the euro, yet impose different VATs. While efforts are made to harmonize VATs, the process is yet to be completed, which implies that at least from 1999, exchange rates could not mitigate incentive effects of European VATs. While all three of these caveats are likely to exist, the magnitude of the frictions they introduce is unknown and could possibly be small enough that – in spite of their prevalence – VATs are still mostly trade neutral, which calls for an empirical investigation of this question.

In this paper, we empirically assess the trade neutrality of taxes by using all VAT changes that occurred in Member States of the European Union from 1988 to 2016 and estimate their effect on trade flows with trade partners. We find that changes in VAT rates have little to no effect on imports or exports. We estimate upper bounds on trade flow elasticities with respect to VAT rates that are substantially smaller than the previously estimated trade flow elasticities with respect to tariffs. Our finding holds across different specifications, countries, time periods, both for small and large VAT changes, and also for VAT increases and decreases.

The main concern with our approach is that the reforms we use could

[3] For example, Buettner and Madzharova (2016) document that declines in tariffs in developing countries were accompanied by increases in VATs.

be endogenous to economic conditions or could be contemporaneous to other tax changes. We address this concern in the following ways. First, using a narrative approach, in the spirit of Romer and Romer (2010), we document the underlying reasons for the VAT changes and select out any changes implemented as part of stimulus packages or austerity measures and find similar trade flow elasticities with respect to VAT rates. Second, we find no significant pre-trends in trade flows prior to these reforms.

Our findings are important for two reasons. First, in spite of the prevalence of VATs in the world, there is very limited work analyzing them. Our paper helps further our understanding of how VATs affect the world economies.[4] This paper is most related to a literature that estimates the effect of VATs on trade, such as Desai and Hines (2005), Keen and Syed (2006), Nicholson (2010) and, more recently, Freund and Gagnon (2017). This literature finds mixed results on the effect of VATs on trade flows. We contribute to this literature by improving on identification: we use detailed tax rate information across all EU member countries matched to detailed trade flow information on various categories of products across all OECD countries to causally estimate the relationship between tax rates and imports/exports. Our approach yields different results, as we find that VATs have very little effect on trade flows.

Second, our paper contributes to the broader Public Finance literature by considering other margins of tax distortion beyond direct distortions to the taxed commodity. Indeed, most estimates of the distortionary effects of taxation focus on direct effects but do not consider fiscal externalities. Because of their ubiquity, VATs could have far reaching effects beyond their direct effect on prices. While other papers have focused on several indirect effects, such as the effect of VATs on wages, on the cost of intermediate outputs or firm entry and exit, few papers have considered the indirect effect that taxes can have on trade.

[4] Pomeranz (2015) and Naritomi (2018) study the effect of VAT on tax evasion; while Carbonnier (2007), Benzarti and Carloni (2019) and Benzarti et al. (2017) explore the effect of VATs on prices and firm behaviors.

2 Data and Institutional Background

Value Added Taxes: VATs are a form of indirect taxation that applies to the value-added of goods and services sold. Sales taxes, excise taxes and VATs are theoretically equivalent but there are a few differences in the way they are implemented. First, intermediate inputs are subject to VATs but firms can claim credits for the VAT that they pay on input costs, which implies that only value-added is ultimately taxed and the statutory incidence of VATs falls on final consumers, similarly to sales taxes. Second, VATs in the EU are included in consumer prices, while sales taxes in the U.S. are not. Third, EU member countries have several VAT rates in place, including a standard rate that applies to most commodities and reduced rates for food, heating and passenger transport. There are also some commodities that are not subject to VATs, such as commodities offered by not-for-profit institutions.

Importantly for this analysis, VATs, sales taxes and excise taxes in the EU, the US and around the world are border adjustable, i.e., imports are subject to these taxes while exports are not. The WTO makes a clear distinction between sales taxes, excise taxes and VATs, on the one hand, and tariffs, on the other; the latter are considered to be trade barriers.

Historical VAT Data: We use the data on historical VAT rates compiled by Benzarti et al. (2017). The database contains detailed information on VAT rates by commodity and country, and the exact dates of tax rate changes. The data covers all commodities subject to VATs but does not contain information on VAT re-classifications, i.e. commodities that are re-classified from the standard to the reduced VAT rate and vice versa. These re-classifications are relatively rare, as they are only allowed by the European Commission under very special circumstances.

Trade Data: The information on export and import flows was obtained from the European Commission Eurostat database.[5] The trade data records trade

[5] The trade data (Table DS-016890) is periodically updated. The version of the data used in this paper was downloaded on April 11, 2017.

flows between members of the European Union and their partners from 1988 to 2016. For this reason, the data availability depends on the year a given country joined the EU or announced such plans: trade data is available starting from 1988 for Austria, Denmark, France, Finland, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom; while data for Belgium and Luxembourg is available from 1999; and data for Bulgaria, the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia is available from 2000 on. Finally, trade flows for Croatia are available starting from 2002. The detailed data is broken down by the Combined Nomenclature levels (HS2, HS4, HS6 and CN8). For each product category, Eurostat records monthly import and export flows in euros and tons, as well as trade quantities in supplementary units for some goods, separately for each partner country. Partner countries include all countries of the world.

Matching the Trade Data with the Tax Data: Because VATs only apply to final products, the first step in the matching process is to exclude categories of goods that are likely to be used as intermediate products. To do so we rely on the United Nations Broad Economic Categories (BEC) classification, which divides products into four categories according to a given good's main use: (1) intermediate, (2) consumption, (3) capital goods and (4) others. We exclude categories 1 and 3 as they are not subject to VATs. Category 4 contains some products that can be used both as a means of production or as consumption goods by individuals, e.g. a car, which can be used by firms or individuals. Our main analysis only includes consumption goods (category 3), however, the results are robust to including goods that can be used both as a means of production or as final goods (category 4). We then match the BEC categories to the Harmonized System (HS) categories, which is the classification used in the trade data.

3 The Effect of VATs on Trade

3.1 Empirical Approach

To estimate the effect of VAT rate changes on trade flows, we follow the approach of Evans et al. (1999), Serrato et al. (2016) and Fuest et al. (2018) by running the following fixed effects regression and including leads and lags of tax rates:

$$\ln(Trade_{icpt}) = \sum_{k=-K}^{k=K} \gamma_k \ln(1+\tau_{ic,t+k}) + \delta_i + \mu_c + \kappa_p + \lambda_t + X_{ct} + Y_{pt} + \varepsilon_{icpt}, \quad (1)$$

where $Trade_{icpt}$ measures imports or exports in euros or kilos for commodity i for declarant country c with partner p at time t, τ_{ict} measures the VAT rate in the declarant country c at time t for commodity i. Time is measured monthly or quarterly. Declarant's controls X_{ct} include declarant's GDP and whether the declarant is a member of the Eurozone. Y_{pt} measures the partner's GDP. The main coefficient of interest is γ_0. It is the elasticity of trade flows (imports or exports) at the time of the VAT rate change: for example, if $\gamma_0 = 0$, then trade flows do not respond to VAT changes, and if $\gamma_0 = 1$, then a one percentage point change in VAT rates leads to a one percent change in trade flows.[6] For $k < 0$, the γ_k coefficients estimate the lagged response of trade flows, k months after the VAT rate change takes place. Conversely, for $k > 0$, the γ_k coefficients estimate anticipatory responses, k months before the VAT rate changes take place.

This fixed effects regression with leads and lags generalizes a difference-in-differences specification with multiple periods, commodities and countries. The main identification assumption is the same as that for difference-in-differences regressions: absent the tax change, there would have been no change in trade flows of the treated relative to the untreated commodities. Figures 1 and 2, which plot the leads and lags coefficients estimated using (1), show no pre-trends in the response of trade flows to VAT rate changes, which supports this

[6] Under the assumption that $\log(1+\tau) \approx \tau$ for small values of τ.

identification assumption. The identification is obtained from within-country specific-commodity variation in VAT rates over time.

3.2 Regression Estimates

To reduce the effect of measurement error and to ensure that our results are not driven by unit, time or commodity aggregation, we run specification (1) along three different dimensions of the data. First, we aggregate the data in two ways, by trading partners or by commodities. When aggregating by partner level, we focus on trade flows at HS4 level, using specification

$$\ln\left(Trade_{ict}\right) = \sum_{k=-K}^{k=K} \gamma_k \ln(1 + \tau_{ic,t+k}) + \delta_i + \mu_c + \lambda_t + X_{ct} + \varepsilon_{ict}. \qquad (2)$$

When aggregating by commodities, we collapse by VAT rate type, and focus on the following partner-countries: USA, China, Japan, Mexico, Canada, Korea, Turkey, Australia, as well as every "eventual" EU country (i.e., all current 27 EU Member States). The rest of the trade partners are combined into one observation. This results in specification:

$$\ln\left(Trade_{cpt}\right) = \sum_{k=-K}^{k=K} \gamma_k \ln(1 + \tau_{c,t+k}) + \zeta_\tau + \mu_c + \kappa_p + \lambda_t + X_{ct} + Y_{pt} + \varepsilon_{cpt}, \qquad (3)$$

where ζ_τ denote VAT rate type fixed effects. Second, we use two different measures of trade, which are volume (tons) and value (euros). And third, we consider both monthly and quarterly trade flows. Overall, this amounts to running eight different specifications.

Figure 1 plots the results of running specification (2) on quarterly data, for both tons and euros, aggregated by partner country. The corresponding regression outputs are reported in Table 1. Similar results based on specification (3) are available in Figure 2 and Table 2. Monthly level results are reported in Appendix Figures A.1 and A.2 and Appendix Tables A.1 and A.2.

Consistently across all specifications, we find that trade flows – be it exports or imports – are barely affected by changes in VAT rates. Our estimates imply a 95% confidence bound of the elasticity of trade flows, γ_0, in value (euros), with respect to VAT rates of 1.76 and 2.47 for imports and exports, respectively. The bounds on the estimates in tons are smaller and equal to 1.38 and 1.51 for imports and exports, respectively. Such elasticities are smaller than trade flow elasticities with respect to tariffs, as discussed in Section 4.

Importantly for our identification strategy, we detect no evidence of pre-trends, anticipatory or lagged responses, as can be seen in Figures 1 and 2. This mitigates concerns that VAT changes are implemented as a response to trade flow changes.

3.3 Robustness Checks

To ensure that our results are not driven by our choice of aggregation, specific reforms or subsets of the data, we perform several robustness checks. For all of five of the following specifications, we find coefficients of similar magnitudes as the ones estimated using our main specifications (reported in Tables 1 and 2), which mitigates our concerns that our elasticity estimates are spurious. First, we run specification (1) on the disaggregated HS4 categories. Because of the large number of product categories and partners, we perform this analysis in differences.[7] The results are available in Figure A.3 and Table A.3. Second, we estimate equation (2) separately for standard and reduced tax rates (Table A.1), and equation (3) separately for within-EU trades and not (Table A.2). Third, we run specifications (2) and (3) separately on VAT increases and decreases in (Appendix Table A.4). We do so because the pass-through of VATs to domestic prices is a key parameter in determining the responsiveness of trade flows to VAT rates, and Benzarti et al. (2017) show that pass-through rates are different for VAT increases and decreases. Fourth, to ensure that the absence of response of trade flows to VAT rates is not due to the fact that the VAT rate changes are small, we run specification (1) on the 25% largest VAT changes (Appendix Table A.5). Fifth, to ensure that our reforms do not

[7] In addition, we run specifications (2) and (3) in differences. The results are very similar and are available upon request.

occur at the same time as recessions, which in turn could affect trade flows, we exclude any reforms that are part of stimulus packages (Table A.6). Sixth, we consider Eurozone and non-Eurozone declarants separately (Table A.7), to account for potential differences in exchange rate adjustments.

Overall, all of these different specifications yield similar results to our baseline specification.

4 Relation to Trade Cost Elasticities and Discussion

The international trade literature estimates elasticities of trade flows with respect to trade costs. Most of the estimates are derived using variation in tariff costs. Comparing our VAT elasticity estimates to the tariff elasticity estimates derived in the trade literature allows us to assess how close VATs are to tariffs. Our estimated VAT elasticities are systematically smaller than the tariff elasticity estimated by the trade literature.

Our elasticity estimates are systematically smaller than 1, both for imports and exports, in euros and in tons. The implied 95% confidence upper bounds from our estimates are all smaller than 2.5. The most recent elasticity estimate of trade flows with respect to tariffs is from Caliendo and Parro (2015) who find an average elasticity of 4.55 (0.35). As reported in Caliendo and Parro (2015), there are several other estimates in the literature: Romalis (2007) also uses tariff changes under NAFTA and finds a trade elasticity that ranges between 4 and 13; Eaton and Kortum (2002) report elasticity estimates ranging between 3.60 and 12.86, and their preferred estimate is 8.28; Hillberry et al. (2005) find an average elasticity of 17; Broda and Weinstein (2006) find an average elasticity of 17 at the seven-digit (TSUSA), 7 at the three-digit (TSUSA), 12 at the ten-digit (HTS), and 4 at the three-digit (HTS) goods disaggregation. Clausing (2001) and Head and Ries (2001) find elasticities between 7 and 11.4. Yi (2003) considers several trade models and shows that elasticities equal to 15 are needed to match the bilateral trade flows.

Although our settings and approaches are different, we can reject that, for any of our specifications, trade elasticities and VAT elasticities are equal. This implies that VATs are unlikely to distort trade in the way tariffs do.

A key prediction from Feldstein and Krugman (1990) is that exchange rate adjustments could mitigate the real effects of VATs on trade. When considering European countries, this assumption is unlikely to hold, simply because a large number of European countries have adopted a common currency but impose individual VAT rates. If Italy, for example, increases its VAT rate, it could have an effect on the euro, but it is very unlikely for the euro to fully adjust in response to the VAT change, given that the level of the euro also depends on the economies of France, Germany, etc.

However, whether an exchange rate adjustment is necessary, depends on the pass-through of VATs to prices. If the passthrough is 100%, no adjustment is necessary. To see this, suppose the economy is in equilibrium and the domestic goods price p^D equals the world price p^W. Now consider a VAT τ that is imposed on domestic products and imports but not on exports. With a 100% passthrough, equilibrium is reached immediately both in domestic and world markets: the tax-inclusive price of imported goods, $(1+\tau)p^W$, equals to the tax-inclusive domestic price, $(1+\tau)p^D$, and the price of domestic exports, p^D, equals the world price, p^W. The imposition of a VAT rate does not distort the relative prices and therefore does affect imports and exports. Compare this to the case when the passthrough, α, is less than 100%. For a small open economy, the price of imports after the imposition of a VAT, $(1+\tau)p^W$, is higher than that of domestic goods, $(1+\alpha\tau)p^D$, which leads to a reduction in demand for imports. On the other hand, the price of exports, $(1+\alpha\tau)p^D/(1+\tau)$, is lower than the world price, p^W, because exports are exempt from the VAT but the passthrough is less than 100%. This results in increased demand for exported goods. Therefore, with less than full passthrough, equilibrium must be reached through an exchange rate adjustment: an increase in domestic currency eliminates arbitrage opportunities and restores trade balance.

These theoretical arguments thus suggest that trade neutrality of VATs in the EU rely both on the ability of exchange rates to adjust in response to

VAT changes and on the VAT passthrough rates to prices. In recent work, Benzarti et al. (2017) estimate the pass-through of VATs to prices in all EU Member States from 1996 to 2015 and find substantial pass-through of VAT increases to prices. While the passthrough the authors find is not 100%, it helps explain our finding that the effect of VAT rate changes on trade flows is limited.

5 Conclusion

This paper uses a large set of VAT changes to provide empirical evidence on the effect of VATs on trade flows. We find that VATs have very little effect on imports or exports and our elasticity estimates are substantially lower than the tariff elasticities estimated in the trade literature. Our finding has important implications. First, it contributes to the international trade and public finance literatures by providing empirical evidence that VATs do not distort trade. Second, it helps settle a long-lasting debate mostly between the U.S., the WTO and EU Member States as to whether VATs should be treated as tariffs.

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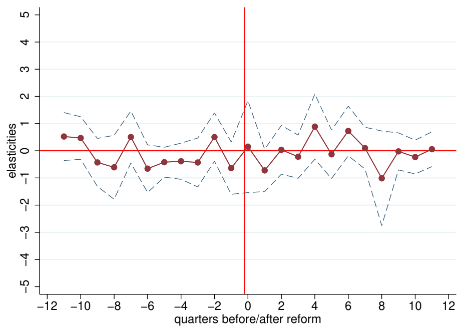
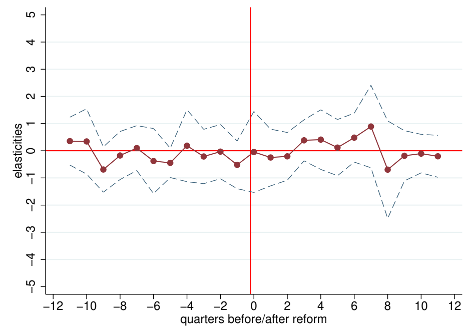
Figure 1: Distributed Lag-Model: Partner Aggregates

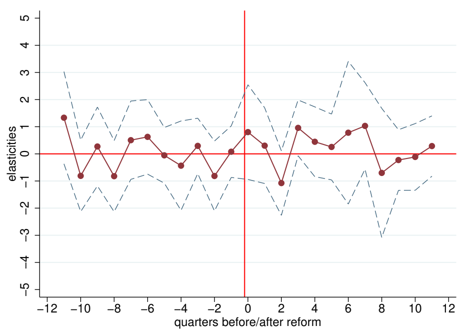
(a) Outcome: Imports in Euros



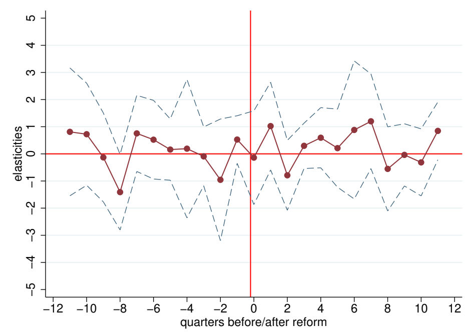
(b) Outcome: Imports in Tons



(c) Outcome: Exports in Euros



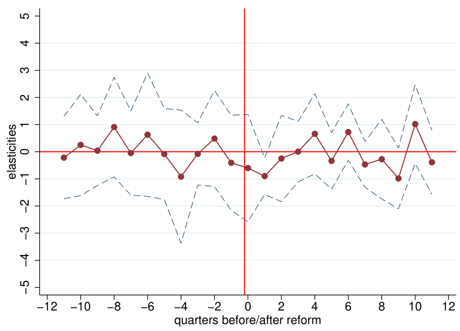
(d) Outcome: Exports in Tons



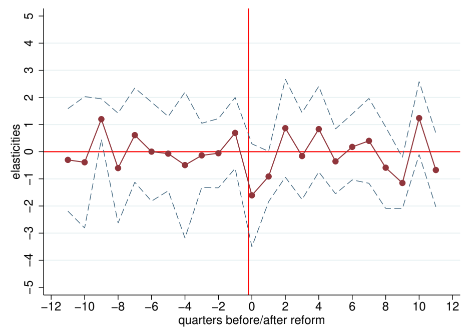
Notes: This figure presents the estimates of γ_k and corresponding 95% confidence intervals from regression model (2), with 12 quarters of leads and lags included. All specifications include declarant, product category, and year-quarter fixed effects, as well as the following controls: declarant's GDP, whether declarant is a Eurozone member, whether a tax change is an increase. Outcome variable measures import and export flows in euros and tons.

Figure 2: Distributed Lag-Model: Product Category Aggregates

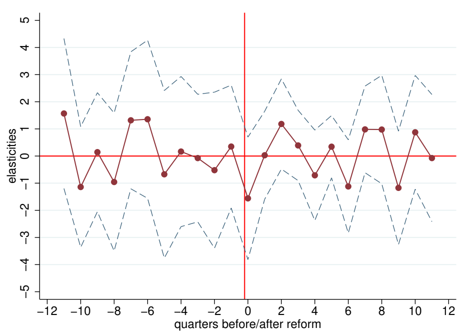
(a) Outcome: Imports in Euros



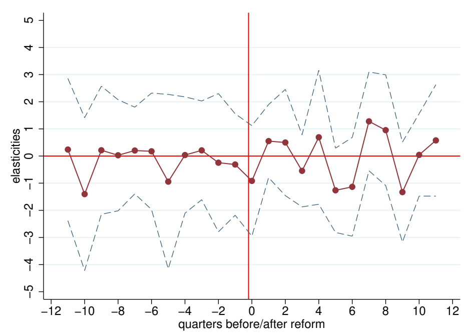
(b) Outcome: Imports in Tons



(c) Outcome: Exports in Euros



(d) Outcome: Exports in Tons



Notes: This figure presents the estimates of γ_k and corresponding 95% confidence intervals from regression model (3), with 12 quarters of leads and lags included. All specifications include declarant, partner, tax rate type and year-quarter fixed effects, as well as the following controls: declarant's and partner's GDP, whether declarant is a Eurozone member, whether a tax change is an increase. Outcome variable measures import and export flows in euros and tons.

Table 1: Distributed Lag-Model: Partner Aggregates

	All Product Categories	
	Euros	Tons
	(1)	(2)
Outcome: $\ln(Imports_t)$		
$\ln(1+\tau_t)$	0.150	-0.045
	(0.823)	(0.725)
N of Observations	763,033	752,434
Outcome: $\ln(Exports_t)$		
$\ln(1+\tau_t)$	0.802	-0.140
	(0.850)	(0.841)
N of Observations	730,242	709,421

Notes: This table presents the estimates of γ_0 from regression model (2), with 12 quarters of leads and lags included (estimates of γ_k for $k \neq 0$ not shown). All specifications include declarant, product category, and year-quarter fixed effects, as well as the following controls: declarant's GDP, whether declarant is a Eurozone member, whether a tax change is an increase. Outcome variable measures import and export flows in euros and tons.

Table 2: Distributed Lag-Model: Product Category Aggregates

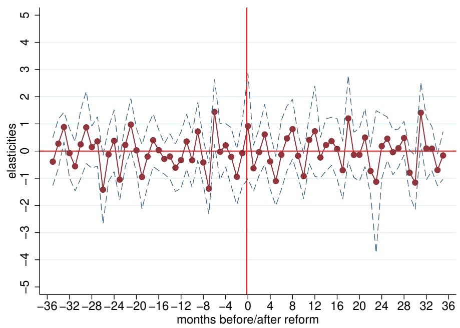
	All Declarants and Partners	
	Euros	Tons
	(1)	(2)
Outcome: $\ln(Imports_t)$		
$\ln(1+\tau_t)$	-0.603	-1.607*
	(0.963)	(0.924)
N of Observations	440,284	414,939
Outcome: $\ln(Exports_t)$		
$\ln(1+\tau_t)$	-1.560	-0.916
	(1.100)	(0.992)
N of Observations	443,375	420,326

Notes: This table presents the estimates of γ_0 from regression model (3), with 12 quarters of leads and lags included (estimates of γ_k for $k \neq 0$ not shown). All specifications include declarant, partner, tax rate type and year-quarter fixed effects, as well as the following controls: declarant's and partner's GDP, whether declarant is a Eurozone member, whether a tax change is an increase. Outcome variable measures import and export flows in euros and tons.

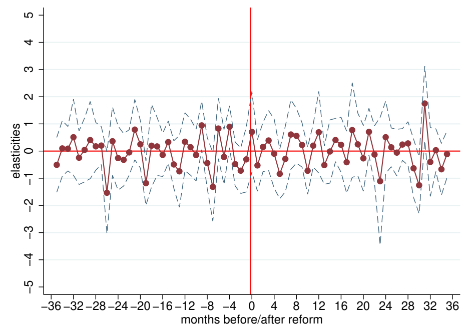
A APPENDIX

Figure A.1: Distributed Lag-Model: Partner Aggregates (monthly)

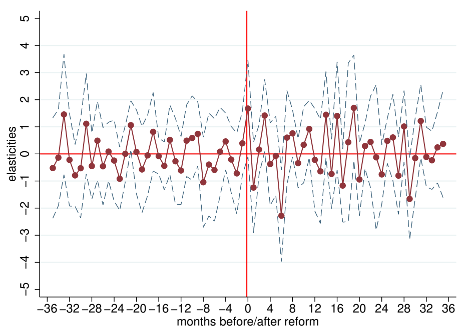
(a) Outcome: Imports in Euros



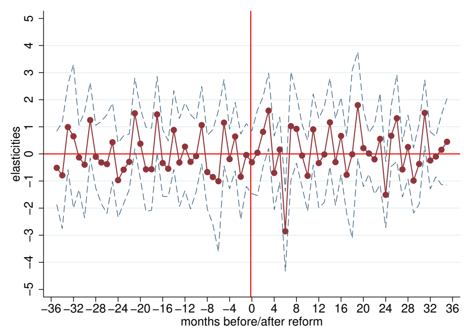
(b) Outcome: Imports in Tons



(c) Outcome: Exports in Euros



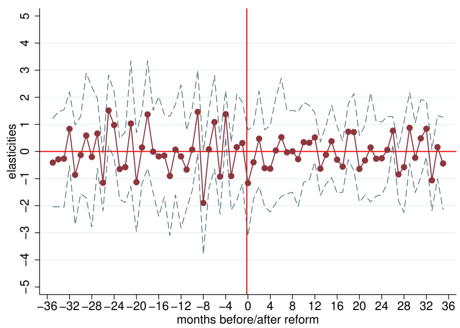
(d) Outcome: Exports in Tons



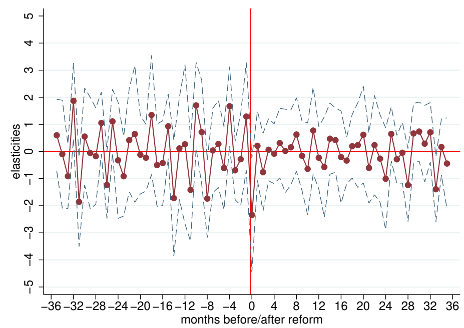
Notes: This figure presents the estimates of γ_k and corresponding 95% confidence intervals from regression model (2), with 36 months of leads and lags included. All specifications include declarant, product category, and year-month fixed effects, as well as the following controls: declarant's GDP, whether declarant is a Eurozone member, whether a tax change is an increase. Outcome variable measures import and export flows in euros and tons.

Figure A.2: Distributed Lag-Model: Product Category Aggregates (monthly)

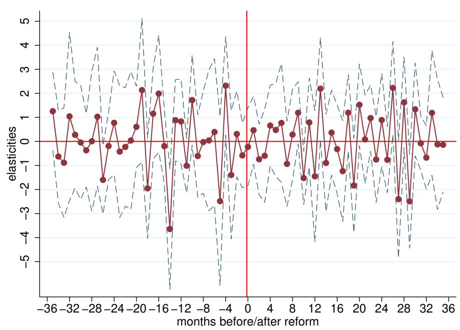
(a) Outcome: Imports in Euros



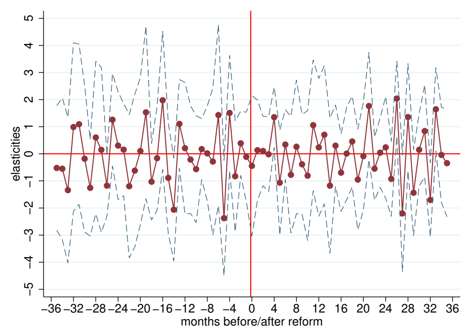
(b) Outcome: Imports in Tons



(c) Outcome: Exports in Euros

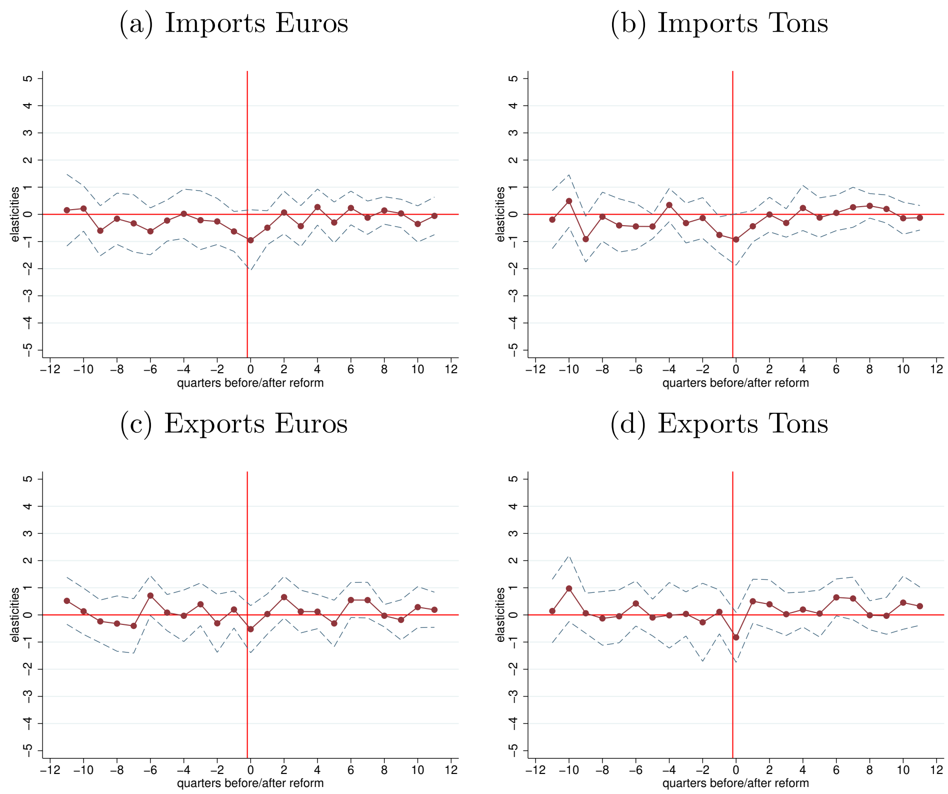


(d) Outcome: Exports in Tons



Notes: This figure presents the estimates of γ_k and corresponding 95% confidence intervals from regression model (3), with 36 months of leads and lags included. All specifications include declarant, partner, tax rate type and year-month fixed effects, as well as the following controls: declarant's and partner's GDP, whether declarant is a Eurozone member, whether a tax change is an increase. Outcome variable measures import and export flows in euros and tons.

Figure A.3: Distributed Lag-Model: HS4 Unaggregated Categories



Notes: This figure presents the estimates of γ_k and corresponding 95% confidence intervals from regression model (1), with 12 quarters of leads and lags included. The model is estimated in first differences. All specifications include year-quarter fixed effects, as well as the following controls: declarant's and partner's GDP, whether declarant is a Eurozone member, whether a tax change is an increase. Outcome variable measures import and export flows in euros and tons.

Table A.1: Distributed Lag-Model: Partner Aggregates (Monthly)

	All Product Categories		Standard Rate Only		Reduced Rate Only	
	Euros	Tons	Euros	Tons	Euros	Tons
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome: $\ln(Imports_t)$						
$\ln(1+\tau_t)$	0.918	0.705	0.992	1.058	0.759	0.494
	(0.946)	(0.725)	(1.334)	(1.179)	(0.914)	(0.570)
N of Observations	2,272,576	2,225,471	1,453,073	1,415,070	819,503	810,401
Outcome: $\ln(Exports_t)$						
$\ln(1+\tau_t)$	1.675*	-0.308	-0.589	-0.589	2.333	0.325
	(0.867)	(0.564)	(0.680)	(0.680)	(1.689)	(1.364)
N of Observations	2,125,759	2,044,844	1,293,893	1,293,893	766,824	750,951

Notes: This table presents the estimates of γ_0 from regression model (2), with 36 months of leads and lags included (estimates of γ_k for $k \neq 0$ not shown). Columns (1) and (2) include all trade flows. Columns (3) and (4) restrict the sample to product categories subject to the standard rate only, while columns (5) and (6) include only reduced-rate products. All specifications include declarant, product category, and year-month fixed effects, as well as the following controls: declarant's GDP, whether declarant is a Eurozone member, whether a tax change is an increase. Outcome variable measures import and export flows in euros and tons.

Table A.2: Distributed Lag-Model: Product Category Aggregates (Monthly)

	All Declarants and Partners		EU Declarant and Partner		Non-EU Declarant or Partner	
	Euros	Tons	Euros	Tons	Euros	Tons
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome: $\ln(Imports_t)$						
$\ln(1+\tau_t)$	-1.165	-2.342**	-0.418	-2.621**	-2.337	-2.485
	(0.954)	(1.026)	(1.268)	(0.996)	(1.764)	(2.252)
N of Observations	1,197,518	1,121,795	686,594	651,876	510,924	469,919
Outcome: $\ln(Exports_t)$						
$\ln(1+\tau_t)$	-0.227	-0.447	-1.888	-1.733	-0.464	-0.248
	(0.793)	(1.261)	(1.401)	(1.353)	(1.423)	(1.632)
N of Observations	1,218,291	1,148,220	697,624	662,584	520,667	485,636

Notes: This table presents the estimates of γ_0 from regression model (3), with 36 months of leads and lags included (estimates of γ_k for $k \neq 0$ not shown). Columns (1) and (2) include all trade flows. Columns (3) and (4) look at the within-EU trade, where both declarant and partner are EU members. In columns (5) and (6), either declarant or partner or both are non-EU members. EU membership is assigned based on the official year of joining the EU. Separate trade flows recorded for all eventually-EU countries, as well as Japan, Mexico, Turkey, Korea, Canada, Australia, China, USA. For all other partner countries, trade flows are combined into one observation. All specifications include declarant, partner, tax rate type and year-month fixed effects, as well as the following controls: declarant's and partner's GDP, whether declarant is a Eurozone member, whether a tax change is an increase. Outcome variable measures import and export flows in euros and tons.

Table A.3: Distributed Lag-Model: HS4 Unaggregated Categories

	All Declarants, Partners and HS4 Categories	
	Euros	Tons
	(1)	(2)
Outcome: $\ln(Imports_t)$		
$\ln(1+\tau_t)$	-0.953*	-0.925*
	(0.547)	(0.462)
N of Observations	11,145,430	9,798,576
Outcome: $\ln(Exports_t)$		
$\ln(1+\tau_t)$	-0.525	-0.828*
	(0.423)	(0.448)
N of Observations	11,371,157	9,956,212

Notes: This table presents the estimates of γ_k and corresponding 95% confidence intervals from regression model (1), with 12 quarters of leads and lags included. The model is estimated in first differences. All specifications include year-quarter fixed effects, as well as the following controls: declarant's and partner's GDP, whether declarant is a Eurozone member, whether a tax change is an increase. Outcome variable measures import and export flows in euros and tons.

Table A.4: Robustness Checks: Increases and Decrease

	Increases		Decreases	
	Euros	Tons	Euros	Tons
	(1)	(2)	(3)	(4)
Outcome: $\ln(Imports_t)$**, Partner Aggregates**				
$\ln(1+\tau_t)$	-0.837	-0.388	0.196	-0.146
	(0.924)	(1.130)	(0.897)	(1.160)
N of Observations	712,862	703,506	596,113	590,241
Outcome: $\ln(Exports_t)$**, Partner Aggregates**				
$\ln(1+\tau_t)$	2.342	2.901	-1.320	-2.605*
	(1.498)	(1.996)	(1.595)	(1.489)
N of Observations	673,901	657,485	564,109	551,713
Outcome: $\ln(Imports_t)$**, Product Category Aggregates**				
$\ln(1+\tau_t)$	-3.062**	-4.804***	1.727*	1.309
	(1.466)	(1.338)	(0.982)	(0.855)
N of Observations	396,454	379,515	350,233	334,974
Outcome: $\ln(Exports_t)$**, Product Category Aggregates**				
$\ln(1+\tau_t)$	-0.371	-0.498	2.465	4.133*
	(1.676)	(1.729)	(2.015)	(2.282)
N of Observations	403,761	388,257	357,883	344,228

Notes: This table presents the estimates of γ_0 from regression models (2) and (3), with 12 quarters of leads and lags included (estimates of γ_k for $k \neq 0$ not shown). Columns (1) and (2) consider tax increases: a given quarter is included only if there was no tax decrease within plus/minus 12 quarters. Columns (3) and (4) consider tax decreases and follow a similar selection approach.

Table A.5: Robustness Checks: Large Tax Changes

	All Product Categories	
	Euros	Tons
	(1)	(2)
Outcome: $\ln(Imports_t)$, **Partner Aggregates**		
$\ln(1+\tau_t)$	-2.347*	-1.412
	(1.328)	(1.008)
N of Observations	579,621	573,847
Outcome: $\ln(Exports_t)$, **Partner Aggregates**		
$\ln(1+\tau_t)$	-4.994**	-4.052**
	(1.978)	(1.845)
N of Observations	547,972	535,781
Outcome: $\ln(Imports_t)$, **Product Category Aggregates**		
$\ln(1+\tau_t)$	-1.231	-2.083
	(1.576)	(1.793)
N of Observations	347,620	332,581
Outcome: $\ln(Exports_t)$, **Partner Category Aggregates**		
$\ln(1+\tau_t)$	-0.457	0.826
	(1.371)	(1.318)
N of Observations	355,022	341,465

Notes: This table presents the estimates of γ_0 from regression models (2) and (3), with 12 quarters of leads and lags included (estimates of γ_k for $k \neq 0$ not shown). Only large tax changes – greater than 4 pp (equivalent of 75th percentile) – are included. A given quarter is included only if there was no smaller tax change within plus/minus 12 quarters.

Table A.6: Robustness Checks: No Austerity

	All Product Categories	
	Euros	Tons
	(1)	(2)
Outcome: $\ln(Imports_t)$, **Partner Aggregates**		
$\ln(1+\tau_t)$	-0.149	0.231
	(0.949)	(0.876)
N of Observations	692,540	683,403
Outcome: $\ln(Exports_t)$, **Partner Aggregates**		
$\ln(1+\tau_t)$	0.705	0.370
	(1.172)	(1.096)
N of Observations	655,567	639,885
Outcome: $\ln(Imports_t)$, **Product Category Aggregates**		
$\ln(1+\tau_t)$	-0.736	-1.384
	(1.181)	(1.113)
N of Observations	384,752	368,324
Outcome: $\ln(Exports_t)$, **Partner Category Aggregates**		
$\ln(1+\tau_t)$	-0.014	0.400
	(1.223)	(1.326)
N of Observations	391,810	376,766

Notes: This table presents the estimates of γ_0 from regression models (2) and (3), with 12 quarters of leads and lags included (estimates of γ_k for $k \neq 0$ not shown). Only tax changes that are not part of stimulus packages are included. A given quarter is included only if there was no tax change within plus/minus 12 quarters that was due to a stimulus package.

Table A.7: Robustness Checks: Currency Regime

	Declarant in Eurozone		**Declarant not in Eurozone**	
	Euros	Tons	Euros	Tons
	(1)	(2)	(3)	(4)
Outcome: $\ln(Imports_t)$, **Partner Aggregates**				
$\ln(1+\tau_t)$	-1.335*	-0.945	-0.583	-0.527
	(0.744)	(1.131)	(0.493)	(0.582)
N of Observations	329,480	325,571	423,033	414,170
Outcome: $\ln(Exports_t)$, **Partner Aggregates**				
$\ln(1+\tau_t)$	-0.955	-0.866	-0.147	-0.815
	(0.693)	(0.970)	(0.634)	(0.621)
N of Observations	311,621	302,268	399,849	384,933
Outcome: $\ln(Imports_t)$, **Product Category Aggregates**				
$\ln(1+\tau_t)$	0.832	0.129	0.081	-0.511
	(1.667)	(2.135)	(0.687)	(0.786)
N of Observations	187,537	177,374	224,161	208,636
Outcome: $\ln(Exports_t)$, **Product Category Aggregates**				
$\ln(1+\tau_t)$	3.999	1.303	-0.005	0.545
	(4.090)	(2.905)	(0.664)	(0.633)
N of Observations	197,171	188,290	220,583	206,091

Notes: This table presents the estimates of γ_0 from regression models (2) and (3), with 12 quarters of leads and lags included (estimates of γ_k for $k \neq 0$ not shown). Columns (1) and (2) only include observations in which declarant was in the Eurozone at time t. Columns (3) and (4) only include observations in which declarant was not in the Eurozone at time t.