Trade and currency weapons

Agnès Bénassy-Quéré*, Matthieu Bussière†, Pauline Wibaux*

* University Paris 1 - Panthéon Sorbonne, Paris School of Economics
† Banque de France

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Motivation

- In theory: (i) Equivalence between import tariff/export subsidy and exchange-rate depreciation (Lerner, 1936); (ii) Trade wars are a negative-sum game while currency wars are neutral at least in the long term.
- However: (i) general equilibrium results may not apply in the short term, and (ii) governments may be short-sighted.
- At the ZLB there are incentives for beggar-thy-neighbor policies (Caballero et al., 2015; Gourinchas and Rey, 2016).
- Our paper: (i) Compares the impact of import tariffs and exchange rates on trade; (ii) Draws some policy implications about the incentives to use both instruments for short-term macro stabilization.

Literature

- Equivalence between taxes and exchange rates: Staiger and Sykes (2010), Lindé and Pescatori (2017), Barbiero et al. (2018), Eichengreen (2018);
- Currency manipulations and wars: Cline and Williamson (2010), Bergsten and Gagnon (2012), Eichengreen (2013), Blanchard (2017);
- Trade elasticities: Ruhl (2008), De Sousa et al. (2012), Fitzgerald and Haller (2014), Head and Mayer (2014), Fontagné et al. (2017).

Main results

- A 10% increase in import tariffs reduces imports by 14%; a 10% depreciation in the RER decreases imports by 5%: tariffs have three times more impact on imports than the ER.
- A government with 2 objectives (internal and external equilibria) will react to a negative demand shock by either increasing the import tariff or lowering the interest rate (and letting the currency depreciate).
- If both instruments can be combined, the government will lower both the interest rate and the import tariff.
- Monetary policy is more stabilizing than trade policy, except at the ZLB. In normal times, a government will react to a trade 'agression' with monetary policy rather than tariffs.

Outline

Data

- 110 countries, for 1989-2013
- Harmonized bilateral trade data, at the HS 6-digit product level from BACI database (CEPII)
- Bilateral PTA and MFN tariffs, HS 6-digit product level from TRAINS database
- Bilateral annual real exchange rates from the IMF and USDA
- GDP: Penn World Tables
- Gravity controls (Head et al., 2010)

Figure: Tariff variations

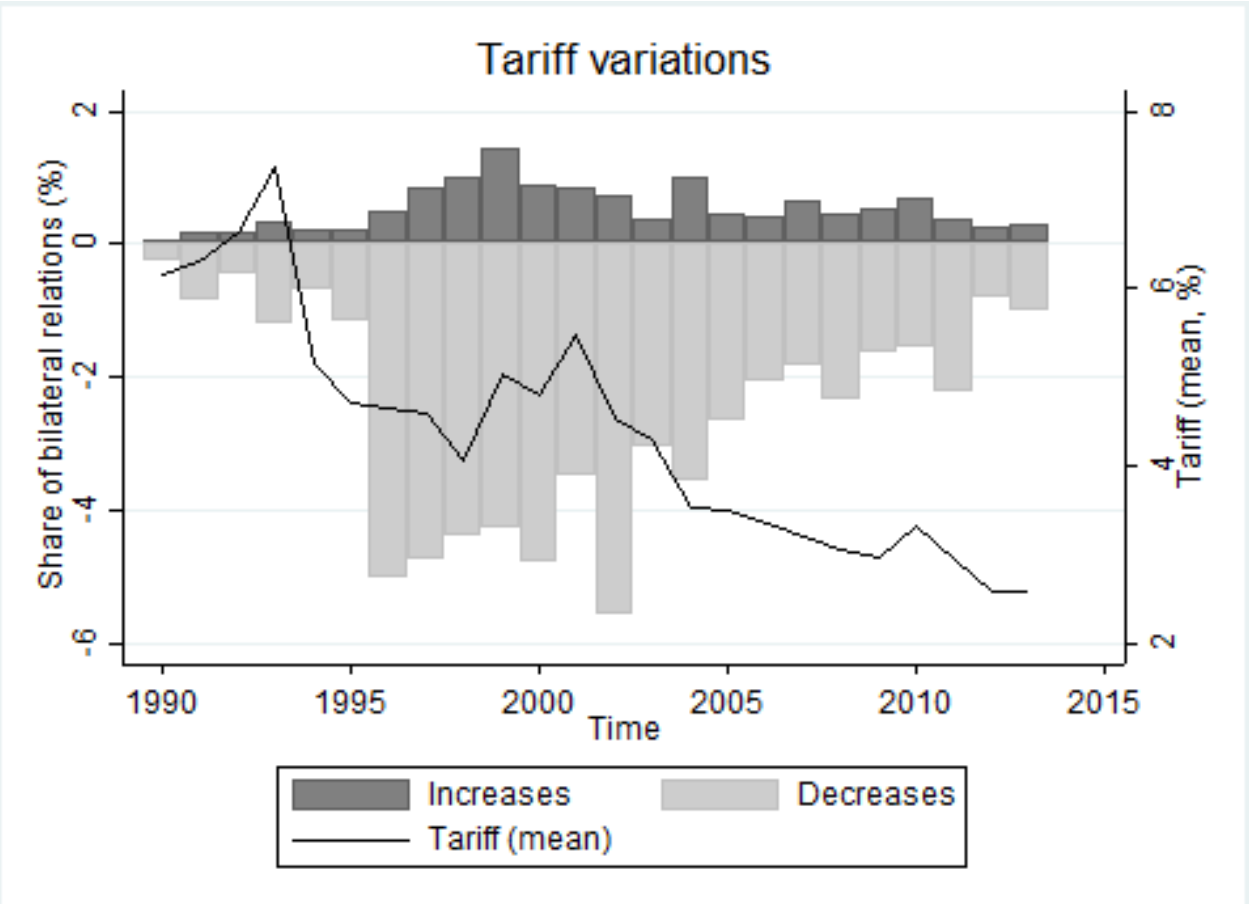
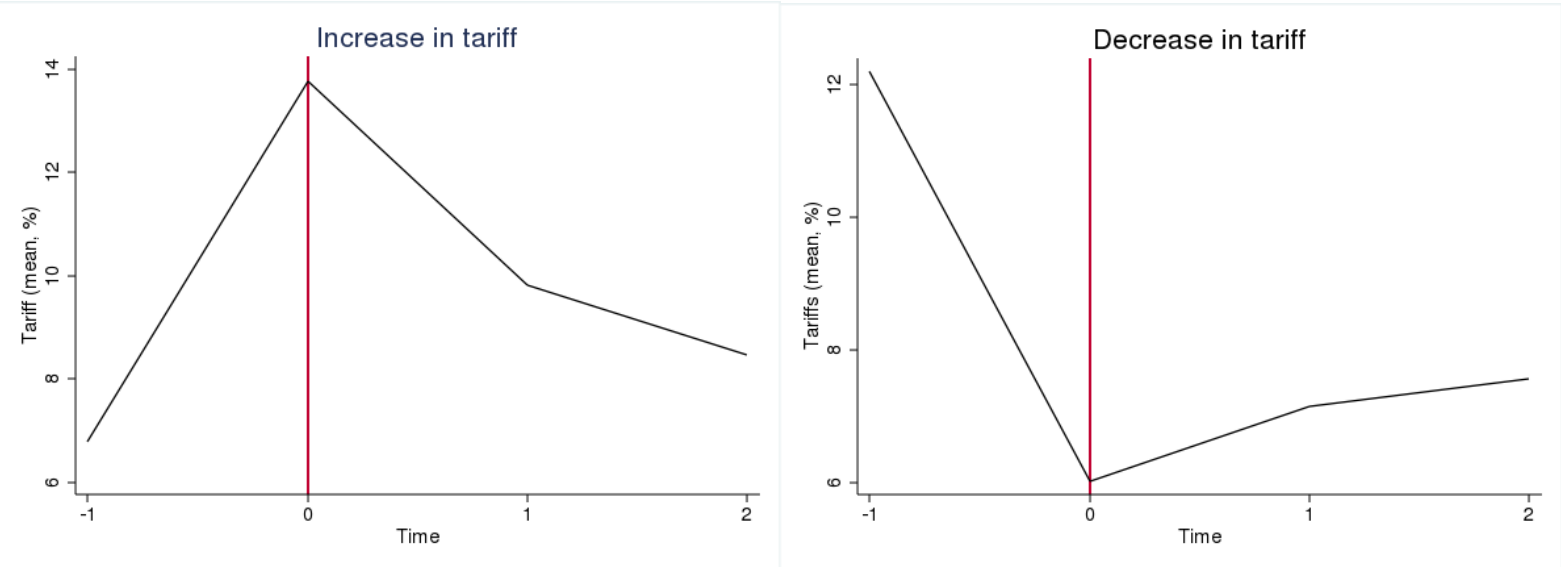
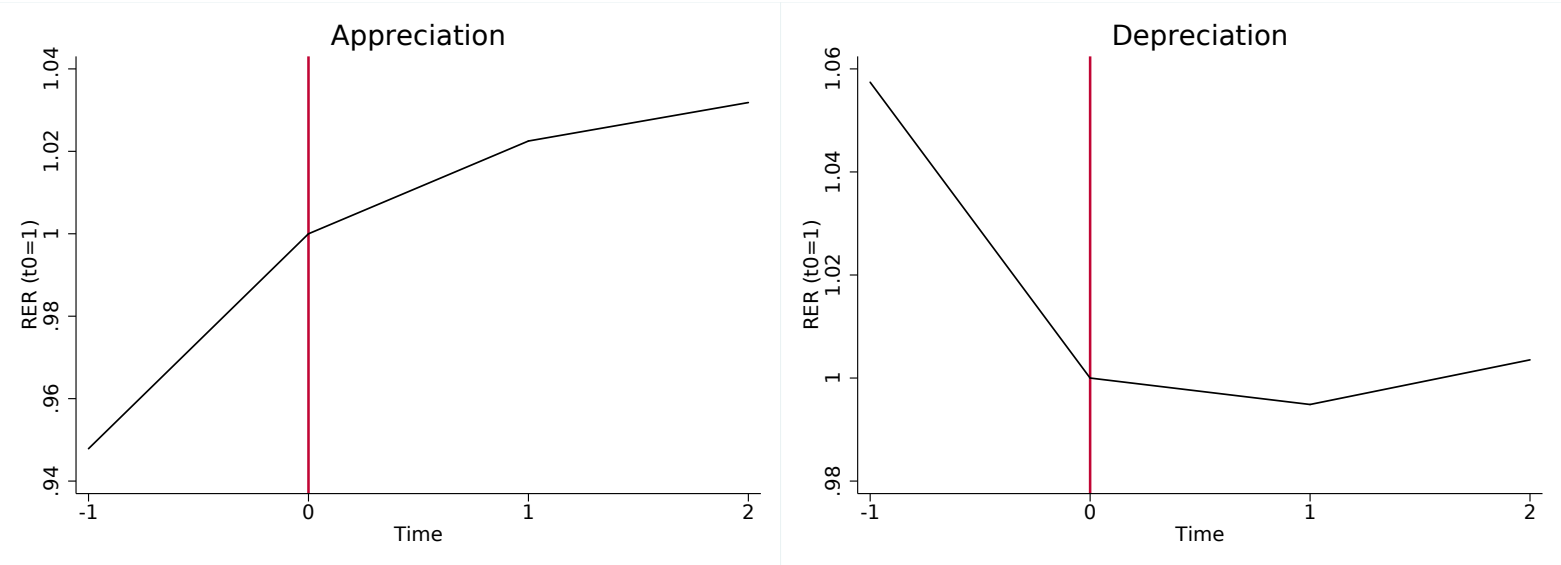


Figure: Lifespan of tariff variations



Note: Time 0 = year of the tariff increase or cut (compared to time -1).

Figure: Lifespan of RER variations



Note: Time 0 = year of the real exchange rate variation (compared to time -1).

Identification strategy

Gravity equation:

$$lnX_{ijkt} = \lambda_{ikt} + \mu_{jkt} + \nu_{ij} + \epsilon_{ijkt} \quad (1)$$

- lnX_{ijkt} is the log of exports in current US dollar of country i to country j of product k in year t.
- λ_{ikt} and μ_{jkt} are exporter and importer product-time fixed effects, to account for size and resistance (multi-lateral resistance terms).
- ν_{ij} is either a country-pair fixed effect, or a set of gravity controls.

Identification issues: introducing the exchange rate in a gravity equation.

$$lnX_{ijkt} = \alpha_1 lnRER_{ijt} + \alpha_2 ln(1+\tau)_{ijkt} + \lambda_{ikt} + \mu_{jkt} + \nu_{ij} + \epsilon_{ijkt} \quad (2)$$

- The RER is not a pure dyadic variable: difference between countries i and j log-price indices expressed in the same currency. Hence its log is colinear to both importer and exporter product-time fixed effects.

Estimated gravity equation:

$$lnX_{ijkt} = \alpha_1 lnRER_{ijt} + \alpha_2 ln(1+\tau)_{ijkt} + \alpha_3 Z_{it} + \lambda_{ik} + \mu_{jkt} + \nu_{ij} + \epsilon_{ijkt} \quad (3)$$

- Drop the time dimension in the exporter-product-time fixed effect (supply side) : λ_{ik}
- Add exporter-time variables to compensate: Z_{it}

Table: Baseline results

	Dependent variable: $Exports_{ijkt}$					
	(1) Standard gravity	(2) Simple gravity	(3) Extended gravity	(4) Baseline	(5) Controls it	(6) Exporter's currency
RER_{ijt}			-0.300***	-0.474***	-0.472***	-0.673***
			(-8.98)	(-8.02)	(-7.99)	(-24.04)
$Tariff_{ijkt}$	-1.864***	-0.546***	-0.637***	-1.366***	-1.365***	-1.823***
	(-183.16)	(-8.03)	(-9.42)	(-14.88)	(-14.88)	(-12.36)
GDP_{it}		0.520***	0.617***	0.694***	0.693***	0.958***
		(13.17)	(17.52)	(12.35)	(12.31)	(88.28)
GDP_{jt}		0.569***	0.440***			
		(25.55)	(14.85)			
$Crisis_{it}$					-0.011*	
					(-1.86)	
FE ikt - jkt - ij	Yes	No	No	No	No	No
FE ijk - t	No	Yes	Yes	No	No	No
FE ik - jkt - ij	No	No	No	Yes	Yes	Yes
Observations	63,746,656	63,363,339	61,611,845	63,203,049	63,203,049	59,751,140
R-squared	0.679	0.771	0.772	0.640	0.640	0.765

Sensitivity

- Baseline: tariff has 2.9 more impact than ER on trade.
- Various robustness checks: specification, pre-crisis period, dollar. Rob
- Different types of goods: equivalence is lower (2.4) for manufactured goods but higher (3.2) for differentiated products. Goods
- Different types of countries: equivalence is lower (2.6) for OECD countries but higher (4.2) for large economies. Countries
- Hike or cut: equivalence is smaller (2.3) for a hike and higher (3.4) for a cut; no asymmetry for appreciation/depreciation. Asymmetries
- On the whole: 2.3 to 4.2.

Policy implications: a stylised model of an open economy

- An open economy in the short run, facing a negative demand shock (inspired from Blanchard, 2017)
- A single 'government' with two objectives: internal and external equilibria
- One or two policy instruments: import tariff, monetary policy
- Two transmission channels: competitiveness, and purchasing power (plus internal channel, for monetary policy)
- Rest of the world: given, or a second country

Model equations

- Government's programme

$$\underset{r,\tau}{MinL} = \frac{1}{2}(y^2 + \theta b^2) \tag{4}$$

- Aggregate demand (in units of domestic good)

$$Y = C + I + EB = cY[E(1+\tau)]^{-\eta} + I_0(1+r)^{-\alpha} + EB \tag{5}$$

- Trade balance (in units of foreign currency)

$$B = X_0 E^{\epsilon}(1+\tau^*)^{-\zeta\epsilon} Y^{*\gamma^*} - M_0 E^{-\epsilon}(1+\tau)^{-\zeta\epsilon} Y^{\gamma} \tag{6}$$

- Uncovered interest parity

$$E = \left(\frac{1+r^*}{1+r}\right)^{\delta} \tag{7}$$

Table: Calibration

Parameter		Value
Propensity to consume	c	0.8
Share of imported goods	η	0.2
Exports / GDP	ϕ	0.1
Internal channel	μ	0.3
UIP persistence	δ	1
RER trade elasticity	ϵ	0.5
Tariff-RER equivalence	ζ	3
GDP trade elasticity	γ	0.6
Degree of mercantilism	θ	1

We calibrate the model to fit the US economy, using the World Bank Development Indicators for the year 2015.

Table: Policy reaction to a negative domestic demand shock: $u = -1\%$

	τ	r	b	y	L
One instrument: τ	0.0230	0	0.0051	-0.0271	0.00004
One instrument: r	0	-0.1171	0.0121	-0.0057	0.00009
Two instruments: τ, r	-0.1087	-0.1630	0	0	0

Note: the table reports deviations from baseline.
Source: model simulations.

Table: Policy reaction to a negative trade shock: $v = -1\%$

	τ	r	b	y	L
One instrument: τ	0.0882	0	0.0047	-0.0253	0.0003
One instrument: r	0	-0.1375	0.0039	-0.0018	0.000009
Two instruments: τ, r	-0.0348	-0.1522	0	0	0

Note: the table reports deviations from baseline.
Source: model simulations.

Table: Policy-mix depending on ζ

	τ	r
Shock $u = -1\%$		
$\zeta = 1$	-0.0806	-0.0403
$\zeta = 2$	-0.0926	-0.0926
$\zeta = 3$	-0.1087	-0.1630
$\zeta = 4$	-0.1316	-0.2632
Shock $v = -1\%$		
$\zeta = 1$	-0.0258	-0.1129
$\zeta = 2$	-0.0296	-0.1296
$\zeta = 3$	-0.0348	-0.1522
$\zeta = 4$	-0.0421	-0.1842

Note: the table reports deviations from baseline.
Source: model simulations.

Table: Policy-mix depending on μ

	τ	r
Shock $u = -1\%$		
$\mu = 0.1$	0.626	0.9375
$\mu = 0.2$	-0.263	-0.3947
$\mu = 0.3$	-0.1087	-0.1630
$\mu = 0.4$	-0.0685	-0.1027
Shock $v = -1\%$		
$\mu = 0.1$	0.6500	0.8750
$\mu = 0.2$	-0.1789	-0.3684
$\mu = 0.3$	-0.0348	-0.1522
$\mu = 0.4$	0.0027	-0.0959

Note: the table reports deviations from baseline.
Source: model simulations.

A two-country extension

- Symmetric countries, symmetric shocks
- Only one instrument each
- Non-cooperative equilibrium (Nash)
- Feedback loop: cutting the home interest rate stimulates foreign income through higher purchasing power; increasing the home import tariff depresses foreign income
- Hence, superiority of monetary policy over trade policy is even greater in two-country setting

Table: Non-cooperative equilibria

	τ, τ^*	r, r^*	b, b^*	y, y^*	L, L^*
Negative domestic demand shocks $u = u^* = -1\%$					
One instrument: τ, τ^*	-0.0714	0	0	0	0
One instrument: r, r^*	0	-0.0926	0	0	0
Negative trade shocks $v = v^* = -1\%$					
One instrument: τ, τ^*	-0.0079	0	-0.01	-0.0297	0.0005
One instrument: r, r^*	0	-0.1051	-0.01	0.0045	0.00006

Note: the table reports deviations from baseline.
Source: model simulations.

Conclusion

- Import tariffs and currency depreciation are partly substitutes in the short run, but:
  - A general increase in tariffs has three times more impact on trade than an equal currency depreciation. However simultaneous increase in all tariffs is unlikely;
  - Monetary policy is more stabilizing due to internal channel (if not muted) and positive feedback loop;
  - Hence, a government will react to a trade agression through monetary rather than trade policy.
- Research perspectives
  - General equilibrium model with capital controls;
  - Sequential game

Table: Robustness checks

Back

	Dependent variable: $Exports_{ijkt}$				
	(1) Baseline	(2) Gravity controls	(3) EU dummy	(4) Pre-crisis 1989-2007	(5) Lagged variables
RER_{ijt}	-0.474***	-0.413***	-0.431***	-0.514***	-0.505***
	(-8.02)	(-7.037)	(-7.936)	(-7.880)	(-6.401)
$Tariff_{ijkt}$	-1.366***	-1.744***	-1.645***	-1.467***	-0.853***
	(-14.88)	(-12.77)	(-11.96)	(-10.16)	(-7.921)
GDP_{it}	0.694***	0.739***	0.735***	0.722***	0.722***
	(12.35)	(15.21)	(15.08)	(11.61)	(11.17)
RTA_{ijt}		0.115***	0.096***	0.143***	
		(3.467)	(2.829)	(3.724)	
$Currency_{ijt}$		0.238***	0.192***	0.231***	
		(4.614)	(3.741)	(4.150)	
$Contiguity_{ij}$		0.555***	0.563***	0.548***	
		(9.571)	(9.687)	(9.085)	
$Language_{ij}$		0.316***	0.319***	0.306***	
		(7.433)	(7.518)	(7.070)	
$Colony_{ij}$		0.303***	0.319***	0.301***	
		(5.821)	(6.089)	(5.676)	
$Distance_{ij}$		-0.833***	-0.819***	-0.816***	
		(-38.38)	(-35.98)	(-36.16)	
EU_{ijt}			0.163***		
			(3.646)		
RER_{ijt-1}					-0.263***
					(6.015)
$Tariff_{ijkt-1}$					-0.0013***
					(-5.253)
GDP_{it-1}					0.176***
					(4.458)
FE ik - jkt	Yes	Yes	Yes	Yes	Yes
FE ij	Yes	No	No	No	Yes
Observations	63,203,049	62,902,461	62,902,461	41,139,004	34,320,029
R-squared	0.640	0.610	0.610	0.616	0.659

Table: US Dollar

	Dependent variable: $Exports_{ijkt}$			
	(1) Extended	(2) Dollar	(3) Volume	(4) Dollar
RER_{ijt}	-0.300***	-0.137***	-0.417***	-0.007
	(-8.98)	(-3.68)	(-9.68)	(-0.13)
$RER_{i\$t}$		-0.360***		-0.943***
		(-5.33)		(10.10)
$Tariff_{ijkt}$	-0.637***	-0.583***	-0.897***	-0.759***
	(-9.42)	(-8.98)	(-10.60)	(-9.64)
GDP_{it}	0.617***	0.800***	0.684***	0.882***
	(17.52)	(16.04)	(13.55)	(15.87)
GDP_{jt}	0.440***	0.507***	0.292***	0.468***
	(14.85)	(15.58)	(8.40)	(12.29)
FE ijk - t	Yes	Yes	Yes	Yes
Observations	61,611,845	61,524,075	60,434,171	60,349,644
R-squared	0.772	0.772	0.790	0.791

Sensitivity analysis

Table: Goods

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			Rauch classification	
	(1) Manuf. products	(2) Agri. products	(3) Homogenous products	(4) Differentiated products
RER_{ijt}	-0.479***	-0.230***	-0.492***	-0.459***
	(0.058)	(0.035)	(0.053)	(0.0607)
	-7.618	-6.58	-9.28	-7.562
$Tariff_{ijkt}$	-1.139***	-1.670***	-1.688***	-1.485***
	(0.166)	(0.076)	(0.0716)	(0.195)
	-10.55	-21.98	-23.55	-7.609
GDP_{it}	0.723***	0.239***	0.612***	0.783***
	15.07	6.80	6.832	12.09
FE ik - jkt - ij	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Observations	54,246,572	4,397,311	17,510,834	42,001,340
R-squared	0.647	0.622	0.611	0.615

Table: Countries

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	(1) Euro area	(2) European Union	(3) OECD countries	(4) Large economies
RER_{ijt}	-0.477***	-0.475***	-0.491***	-0.456***
	(-8.072)	(-8.063)	(-8.323)	(-7.62)
$TARIFF_{ijkt}$	-1.369***	-1.365***	-1.072***	-1.236***
	(-14.90)	(-14.88)	(-11.18)	(-12.70)
GDP_{it}	0.695***	0.694***	0.704***	0.728***
	(12.37)	(12.35)	(12.55)	(6.936)
$RER_{ijt} * EA_{ijt}$	0.262***			
	(2.653)			
$RER_{ijt} * EU_{ijt}$		-0.00551		
		(-0.633)		
$RER_{ijt} * OECD_{ijt}$			0.0257***	
			(3.900)	
$TARIFF_{ijkt} * OECD_{ijt}$			-0.907***	
			(-6.722)	
$RER_{ijt} * Large_{ijt}$				-0.108**
				(-2.26)
$TARIFF_{ijkt} * Large_{ijt}$				-0.879***
				(-4.71)
FE ik - jkt - ij	Yes	Yes	Yes	Yes
Observations	63,203,049	63,203,049	63,203,049	63,203,049
R-squared	0.640	0.640	0.640	0.641

Table: Asymmetric reactions

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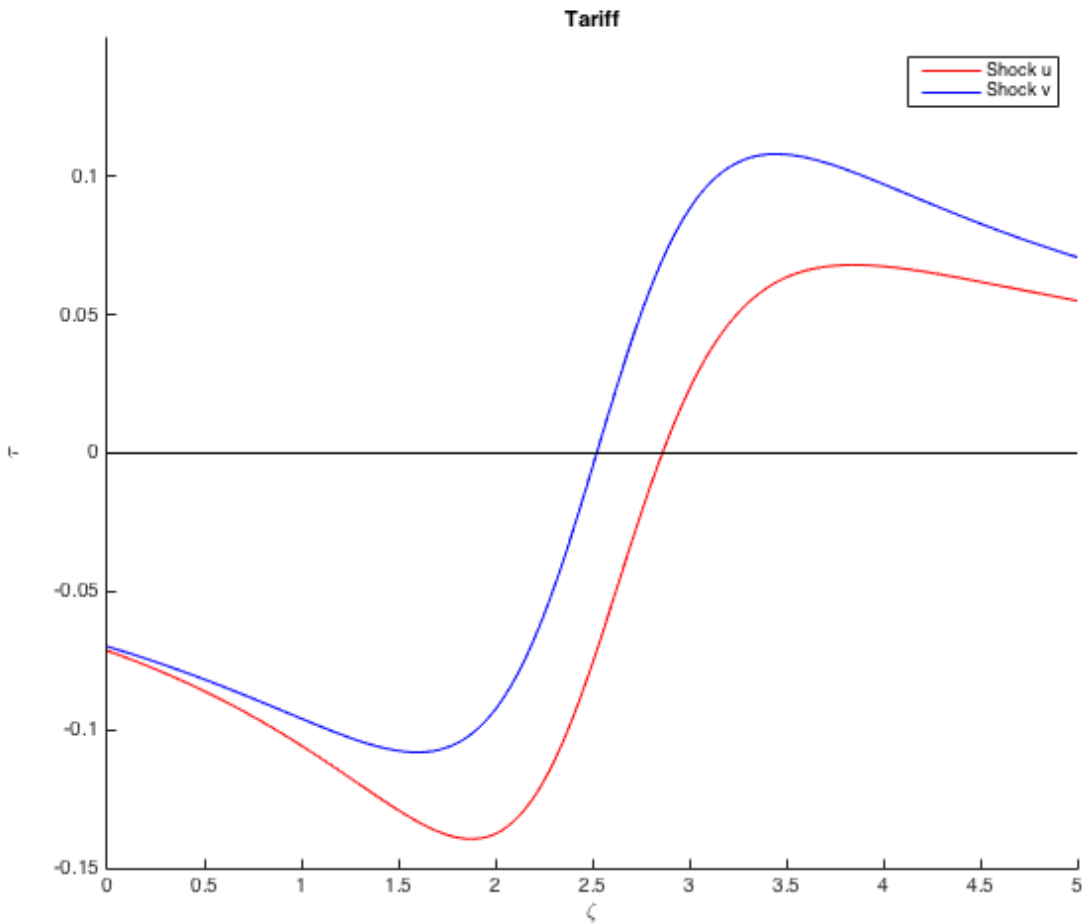
	Dep. var. : $Exports_{ijkt}$			
	(1)	(2)	(3)	(4)
RER_{ijt}	-0.428***	-0.401***	-0.405***	-0.393***
	(-6.773)	(-7.333)	(-7.406)	(-7.204)
$Tariff_{ijkt}$	-1.440***	-1.743***	-1.680***	-1.677***
	(-11.44)	(-12.68)	(-12.18)	(-12.18)
$Tariff_{ijkt} * Increase$	0.461***			
	(6.182)			
$RER_{ijt} * Tariff_{ijkt}$		-0.150***		
		(5.366)		
$RER_{ijt} * Depreciation$			-0.00428**	
			(2.536)	
$RER_{ijt} * Misalignment$				-0.078***
				(3.866)
Controls	Yes	Yes	Yes	Yes
FE ik-jkt	Yes	Yes	Yes	Yes
Observations	44,222,566	63,142,608	63,142,608	63,142,608
R-squared	0.630	0.609	0.609	0.609

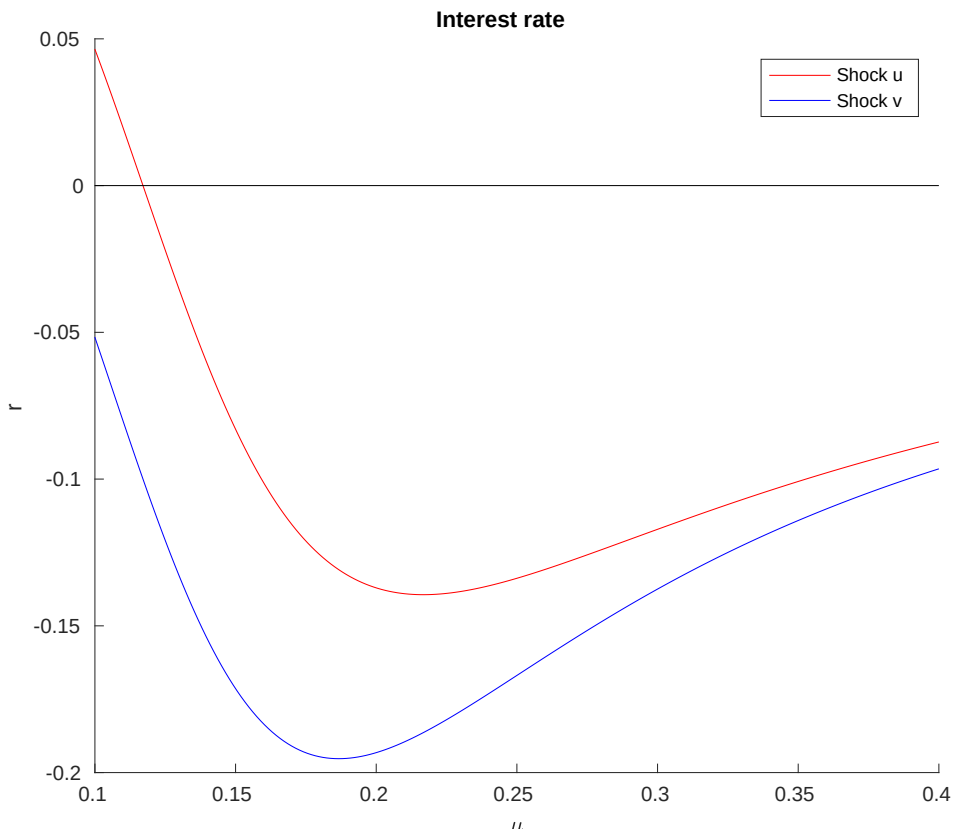
Policy reactions depending on key parameters

Figure: Reaction of tariff depending on ζ



Note: policy responses to a negative demand shock of $u = -1\%$ in red, and to

Figure: Reaction of interest rate depending on μ



Protectionism and macroeconomic variables

- Knetter and Prusa (2003): link between anti-dumping cases and RER variations.
- Bown and Crowley (2011, 2013): an appreciation in t-1 increases the number of temporary trade barriers in t.
- Georgiadis and Gräb (2013)

	Dependent variable: tariffs (%)				
	(1) Whole sample	(2) Pre- crisis (1989-2007)	(3) High income	(4) Upper mid. income	(5) Lower mid. income
RER_{ijt-1}	4.283***	5.808***	1.414***	4.137***	4.057***
	(174.16)	(160.36)	(68.23)	(153.60)	(43.25)
GDP_{jt-1}	-5.976***	-6.627***	-2.417***	-4.027***	-3.444***
	(-189.49)	(-141.19)	(-148.25)	(-135.31)	(-21.57)
GDP_{it-1}	1.702***	3.197***	0.887***	1.090***	1.117***
	(87.23)	(82.42)	(41.54)	(49.44)	(14.66)
$Imports_{jit-1}$	-0.111***	-0.0927***	-0.0141***	-0.105***	-0.294***
	(-44.69)	(-26.05)	(-4.30)	(-38.45)	(-34.60)
Country-pair-product FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
N	28,709,771	19,198,715	15,016,459	8,250,086	5,443,226
R^2	0.592	0.542	0.485	0.698	0.638