Appendix: Can Sticky Quantities Explain Export Insensitivity to Exchange Rates?

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A Firm responses: robustness

Table 1: Revenue, price and quantity sensitivity to macro shocks and tariffs: estimation in differences

		(1)		(2)		(3)	
		Δ ln Revenue		Δ ln Quantity		Δ ln Price	
		coeff	s.e.	coeff	s.e.	coeff	s.e.
Low exit prob	rer_t^k	0.46	(0.17)**	0.06	(0.17)	0.37	(0.09)**
	dem_t^k	1.05	(0.41)**	1.03	(0.44)**	-0.17	(0.23)
	τ_t^{jk}	-0.65	(1.80)	-0.63	(1.69)	-0.49	(0.93)
High exit prob	rer_t^k	0.13	(0.20)	0.09	(0.20)	0.03	(0.11)
	dem_t^k	1.16	(0.44)**	1.27	(0.44)**	-0.36	(0.24)
	τ_t^{jk}	0.23	(1.64)	0.46	(1.79)	-0.53	(1.13)
Export history controls		yes		yes		yes	
Firm-product-year f.e.		yes		yes		yes	
Product-market f.e.		no		no		no	
N		111,966		111,691		111,691	
R^2		0.38		0.39		0.36	
R^2-adj		0.23		0.24		0.20	

Notes: Estimation method is OLS. Dependent variable is in turn change in log Euro revenue, log tonnes and log unit value at the level of the firm-product-market. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.

Table 2: Revenue, price and quantity sensitivity to macro shocks: no interaction with spell length

	(1)		(2)		(3)	
	Revenue		Quantity		Price	
	coeff	s.e.	coeff	s.e.	coeff	s.e.
rer_t^k	0.51	(0.09)**	0.34	(0.09)**	0.17	(0.04)**
dem_t^k	0.81	(0.15)**	0.83	(0.15)**	-0.02	(0.07)
τ_t^{jk}	0.07	(0.68)	-0.01	(0.69)	0.08	(0.37)
Export history controls	yes		yes		yes	
Firm-product-year f.e.	yes		yes		yes	
Product-market f.e.	yes		yes		yes	
N	180,434		180,434		180,434	
R^2	0.77		0.83		0.91	
R^2-adj	0.68		0.76		0.87	

Notes: Estimation method is OLS. Dependent variable is in turn log Euro revenue, log tonnes and log unit value at the level of the firm-product-market. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.

Table 3: Revenue, price and quantity sensitivity to macro shocks: no interaction with spell length, no trajectories

	(1)		(2)		(3)	
	Revenue		Quantity		Price	
	coeff	s.e.	coeff	s.e.	coeff	s.e.
rer_t^k	0.59	(0.09)**	0.42	(0.09)**	0.17	(0.04)**
dem_t^k	0.94	(0.15)**	0.95	(0.16)**	-0.01	(0.07)
τ_t^{jk}	0.10	(0.69)	0.01	(0.71)	0.09	(0.37)
Export history controls	no		no		no	
Firm-product-year f.e.	yes		yes		yes	
Product-market f.e.	yes		yes		yes	
N	180,434		180,434		180,434	
R^2	0.75		0.82		0.91	
R^2-adj	0.66		0.75		0.87	

Notes: Estimation method is OLS. Dependent variable is in turn log Euro revenue, log tonnes and log unit value at the level of the firm-product-market. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.

Table 4: Quantity sensitivity to macro shocks: Firm size

		(1)		(2)		(3)	
		Small		Medium		Large	
		coeff	s.e.	coeff	s.e.	coeff	s.e.
Low exit prob	rer_t^k	0.18	(0.14)	0.39	(0.20)*	0.42	(0.16)**
	dem_t^k	0.40	(0.25)	0.89	(0.34)**	1.32	(0.26)**
	τ_t^{jk}	0.51	(1.66)	-4.92	(1.84)**	-3.74	(1.39)**
High exit prob	rer_t^k	0.15	(0.14)	0.39	(0.20)*	0.39	(0.16)*
	dem_t^k	0.34	(0.25)	0.77	(0.34)**	1.24	(0.25)**
	τ_t^{jk}	2.11	(1.29)	0.00	(1.61)	1.13	(1.24)
Export history controls		yes		yes		yes	
Firm-product-year f.e.		yes		yes		yes	
Product-market f.e.		yes		yes		yes	
N		68,989		42,610		59,847	
R^2		0.86		0.85		0.82	
R^2-adj		0.79		0.78		0.75	

Notes: Small: <100 employees. Medium: 100-249 employees. Large: 250+ employees. Estimation method is OLS. Dependent variable is log tonnes at the level of the firm-product-market. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.

Table 5: Price sensitivity to macro shocks: Firm size

		(1)		(2)		(3)	
		Small		Medium		Large	
		coeff	s.e.	coeff	s.e.	coeff	s.e.
Low exit prob	rer_t^k	0.13	(0.07)*	0.24	(0.09)**	0.17	(0.08)**
	dem_t^k	0.18	(0.12)	0.07	(0.16)	-0.19	(0.14)
	τ_t^{jk}	0.54	(0.91)	-0.07	(0.80)	-0.12	(0.67)
High exit prob	rer_t^k	0.14	(0.07)*	0.24	(0.09)**	0.15	(0.08)**
	dem_t^k	0.18	(0.12)	0.08	(0.16)	-0.19	(0.14)
	τ_t^{jk}	0.46	(0.70)	1.05	(0.84)	-0.93	(0.64)
Export history controls		yes		yes		yes	
Firm-product-year f.e.		yes		yes		yes	
Product-market f.e.		yes		yes		yes	
N		68,989		42,610		59,847	
R^2		0.93		0.93		0.89	
R^2-adj		0.89		0.90		0.85	

Notes: Small: <100 employees. Medium: 100-249 employees. Large: 250+ employees. Estimation method is OLS. Dependent variable is log unit value at the level of the firm-product-market. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.

Table 6: Implied price elasticity of demand: Firm size

	Small	Medium	Large
rer_t^k	0.21	0.51	0.49
τ_t^{jk}	-1.11	4.60	3.34

Table 7: Quantity sensitivity to macro shocks: Ownership

		(1)		(2)	
		Domestic		Foreign	
		coeff	s.e.	coeff	s.e.
Low exit prob	rer_t^k	0.05	(0.14)	0.46	(0.12)**
	dem_t^k	0.29	(0.27)	1.02	(0.18)**
	τ_t^{jk}	0.51	(1.62)	-2.76	(0.97)**
High exit prob	rer_t^k	0.04	(0.14)	0.44	(0.12)**
	dem_t^k	0.22	(0.27)	0.94	(0.18)**
	τ_t^{jk}	3.20	(1.55)**	1.42	(0.87)
Export history controls		yes		yes	
Firm-product-year f.e.		yes		yes	
Product-market f.e.		yes		yes	
N		67,623		107,287	
R^2		0.88		0.80	
R^2-adj		0.82		0.73	

Notes: Estimation method is OLS. Dependent variable is log tonnes at the level of the firm-product-market. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.

Table 8: Price sensitivity to macro shocks: Ownership

		(1)		(2)	
		Domestic		Foreign	
		coeff	s.e.	coeff	s.e.
Low exit prob	rer_t^k	0.26	(0.06)**	0.16	(0.06)**
	dem_t^k	0.21	(0.12)*	-0.07	(0.09)
	τ_t^{jk}	-0.37	(0.88)	-0.01	(0.48)
High exit prob	rer_t^k	0.27	(0.06)**	0.15	(0.06)**
	dem_t^k	0.22	(0.12)*	-0.08	(0.069)
	τ_t^{jk}	-0.01	(0.77)	-0.08	(0.47)
Export history controls		yes		yes	
Firm-product-year f.e.		yes		yes	
Product-market f.e.		yes		yes	
N		67,623		107,287	
R^2		0.94		0.87	
R^2-adj		0.91		0.82	

Notes: Estimation method is OLS. Dependent variable is log unit value at the level of the firm-product-market. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.

Table 9: Implied price elasticity of demand: Ownership

θ_t^{ik}	Domestic	Foreign
rer_t^k	0.07	0.55
τ_t^{jk}	-0.81	2.79

Table 10: Quantity sensitivity to macro shocks: Industry

		(1)		(2)		(3)		(4)		(5)	
		Cons food		Cons nonf nondur		Cons durables		Intermediates		Capital goods	
		coeff	s.e.	coeff	s.e.	coeff	s.e.	coeff	s.e.	coeff	s.e.
Low exit prob	rer_t^k	-0.16	(0.19)	0.59	(0.24)**	-0.10	(0.76)	0.31	(0.18)*	0.48	(0.15)**
	dem_t^k	0.22	(0.38)	0.24	(0.42)	2.61	(1.43)*	0.82	(0.29)**	0.97	(0.24)**
	τ_t^{jk}	-0.60	(1.60)	-5.68	(2.13)**	-2.68	(6.34)	-1.87	(1.56)	-2.92	(1.86)
High exit prob	rer_t^k	-0.14	(0.19)	0.57	(0.24)**	-0.25	(0.76)	0.29	(0.18)	0.45	(0.15)**
	dem_t^k	0.20	(0.38)	0.12	(0.41)	2.51	(1.44)*	0.70	(0.30)**	0.91	(0.24)**
	τ_t^{jk}	0.76	(1.39)	-1.88	(1.78)	4.03	(5.67)	2.68	(1.43)*	1.70	(1.30)
Export history controls		yes		yes		yes		yes		yes	
Firm-product-year f.e.		yes		yes		yes		yes		yes	
Product-market f.e.		yes		yes		yes		yes		yes	
N		35,850		23,986		5,034		45,208		63,938	
R^2		0.78		0.80		0.83		0.85		0.78	
R^2-adj		0.67		0.73		0.72		0.78		0.70	

Notes: Estimation method is OLS. Dependent variable is log tonnes at the level of the firm-product-market. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.

Table 11: Price sensitivity to macro shocks: Industry

		(1)		(2)		(3)		(4)		(5)	
		Cons food		Cons nonf nondur		Cons durables		Intermediates		Capital goods	
		coeff	s.e.	coeff	s.e.	coeff	s.e.	coeff	s.e.	coeff	s.e.
Low exit prob	rer_t^k	0.19	(0.06)**	0.05	(0.14)	0.16	(0.30)	0.32	(0.09)**	0.12	(0.07)**
	dem_t^k	-0.14	(0.11)	0.21	(0.23)	0.30	(0.54)	0.22	(0.17)	-0.11	(0.12)
	τ_t^{jk}	0.26	(0.63)	1.97	(1.54)	2.35	(2.47)	-0.55	(0.82)	-0.16	(0.68)
High exit prob	rer_t^k	0.20	(0.06)**	0.05	(0.14)	0.18	(0.30)	0.31	(0.09)**	0.12	(0.07)*
	dem_t^k	-0.12	(0.11)	0.21	(0.24)	0.32	(0.54)	0.20	(0.17)	-0.10	(0.12)
	τ_t^{jk}	0.38	(0.96)	0.82	(1.27)	-0.49	(1.96)	-0.25	(0.78)	0.27	(0.60)
Export history controls		yes		yes		yes		yes		yes	
Firm-product-year f.e.		yes		yes		yes		yes		yes	
Product-market f.e.		yes		yes		yes		yes		yes	
N		35,850		23,986		5,034		45,208		63,938	
R^2		0.89		0.81		0.86		0.92		0.85	
R^2-adj		0.84		0.74		0.76		0.88		0.80	

Notes: Estimation method is OLS. Dependent variable is log tonnes at the level of the firm-product-market. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.

Table 12: Implied price elasticity of demand: Sector

θ_t^{ik}	(1)	(2)	(3)	(4)	(5)
rer_t^k	-0.20	0.62	-0.12	0.46	0.55
τ_t^{jk}	0.48	1.91	0.80	4.16	3.48

Table 13: Sensitivity to macro shocks: Split exchange rate in nominal and price parts

		(1)		(2)		(3)	
		Revenue		Quantity		Price	
		coeff	s.e.	coeff	s.e.	coeff	s.e.
Low exit prob	x_t^k	0.58	(0.09)**	0.35	(0.09)**	0.23	(0.05)**
	p_t^k	0.65	(0.10)**	0.55	(0.10)**	0.10	(0.05)**
	dem_t^k	0.91	(0.15)**	0.88	(0.15)**	0.03	(0.08)*
	τ_t^{jk}	-2.30	(0.78)**	-2.31	(0.83)**	0.01	(0.42)
High exit prob	x_t^k	0.55	(0.09)**	0.32	(0.09)**	0.23	(0.05)**
	p_t^k	0.23	(0.11)**	0.09	(0.11)	0.14	(0.06)**
	dem_t^k	0.83	(0.15)**	0.80	(0.15)**	0.03	(0.08)
	τ_t^{jk}	1.22	(0.72)	1.09	(0.72)	0.13	(0.39)
Export history controls		yes		yes		yes	
Firm-product-year f.e.		yes		yes		yes	
Product-market f.e.		yes		yes		yes	
N		180,434		180,434		180,434	
R^2		0.77		0.83		0.91	
R^2-adj		0.68		0.76		0.87	

Notes: Estimation method is OLS. Dependent variable is log unit value at the level of the firm-product-market. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.

B Derivation of elasticities

B.1 Model without customer base

Let P_t^{ik*} be the consumer price of firm i's good in market k at time t. Demand is given by:

$$Q_t^{ik} = Q_t^k d\left(\frac{P_t^{ik*}}{P_t^{k*}}\right)\Phi_t^{ik}$$

so

$$\exp\left(\ln Q_t^{ik}\right) = Q_t^k d\left(\frac{\exp\left(\ln P_t^{ik*}\right)}{P_t^{k*}}\right)\Phi_t^{ik}$$

Therefore

$$\frac{\partial \ln Q_t^{ik}}{\partial \ln P_t^{ik*}} Q_t^{ik} = Q_t^k d'\left(\frac{\exp\left(\ln P_t^{ik*}\right)}{P_t^{k*}}\right)\Phi_t^{ik}\frac{P_t^{ik*}}{P_t^{k*}}$$

So the price elasticity of demand is given by:

$$\frac{\partial \ln Q_t^{ik}}{\partial \ln P_t^{ik*}} = \frac{Q_t^k d'\left(\frac{P_t^{ik*}}{P_t^{k*}}\right)\Phi_t^{ik}\frac{P_t^{ik*}}{P_t^{k*}}}{Q_t^{ik}} = \frac{d'\left(\frac{P_t^{ik*}}{P_t^{k*}}\right)\frac{P_t^{ik*}}{P_t^{k*}}}{d\left(\frac{P_t^{ik*}}{P_t^{k*}}\right)} = \theta_t^{ik}$$

Now normalize $P_t = 1$ so that the real exchange rate is $RER_t^k = \frac{E_t^k P_t^{k*}}{P_t} = E_t^k P_t^{k*}$. Then we can write:

$$Q_t^{ik} = Q_t^k d\left(\frac{P_t^{ik*}}{P_t^{k*}}\right)\Phi_t^{ik} = Q_t^k d\left(\frac{\left(1+T_t^{ik}\right)B^k P_t^{ik}/E_t^k}{P_t^{k*}}\right)\Phi_t^{ik}$$

$$Q_t^{ik} = Q_t^k d\left(\frac{\left(1+T_t^{ik}\right)B^k P_t^{ik}}{RER_t^k}\right)\Phi_t^{ik} = Q_t^k d\left(\frac{\left(1+T_t^{ik}\right)B^k \mu_t^{ik} C_t^i}{RER_t^k}\right)\Phi_t^{ik}$$

where μ_t^{ik} may depend on RER_t^k and T_t^{ik}. For the moment, Φ_t^{ik} and B^k are assumed independent of the real exchange rate and tariffs. Potential dependence of Q_t^k and C_t^i on the real exchange rate and tariffs is suppressed, since we explicitly control for these variables in our regressions. Rewrite the above expression:

$$\exp\left(\ln Q_t^{ik}\right) = Q_t^k d\left(\frac{\exp\left(\ln\left(1+T_t^{ik}\right)\right)B^k \exp\left(\ln \mu_t^{ik}\right)C_t^i}{\exp\left(\ln RER_t^k\right)}\right)\Phi_t^{ik}$$

Then
$$\frac{\partial \ln Q_t^{ik}}{\partial \ln RER_t^k} Q_t^{ik} = Q_t^k d'\left(\frac{P_t^{ik*}}{P_t^{k*}}\right) \Phi_t^{ik} \frac{P_t^{ik*}}{P_t^{k*}} \left(\frac{\partial \ln \mu_t^{ik}}{\partial \ln RER_t^k} - 1\right)$$

so
$$\frac{\partial \ln Q_t^{ik}}{\partial \ln RER_t^k} = \frac{Q_t^k d'\left(\frac{P_t^{ik*}}{P_t^{k*}}\right) \Phi_t^{ik} \frac{P_t^{ik*}}{P_t^{k*}}}{Q_t^{ik}} \left(\frac{\partial \ln \mu_t^{ik}}{\partial \ln RER_t^k} - 1\right)$$

and
$$\frac{\partial \ln Q_t^{ik}}{\partial \ln RER_t^k} = \frac{d'\left(\frac{P_t^{ik*}}{P_t^{k*}}\right) \frac{P_t^{ik*}}{P_t^{k*}}}{d\left(\frac{P_t^{ik*}}{P_t^{k*}}\right)} \left(\frac{\partial \ln \mu_t^{ik}}{\partial \ln RER_t^k} - 1\right)$$

Substituting in for the price elasticity of demand we get:

$$\frac{\partial \ln Q_t^{ik}}{\partial \ln RER_t^k} = \theta_t^{ik} \left(\frac{\partial \ln \mu_t^{ik}}{\partial \ln RER_t^k} - 1\right)$$

Let
$$\eta_{Q,RER} = \frac{\partial \ln Q_t^{ik}}{\partial \ln RER_t^k}$$

and
$$\eta_{\mu,RER} = \frac{\partial \ln \mu_t^{ik}}{\partial \ln RER_t^k}$$

so
$$\eta_{Q,RER} = \theta_t^{ik} \left(\eta_{\mu,RER} - 1\right)$$

Similarly

$$\frac{\partial \ln Q_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)} Q_t^{ik} = Q_t^k d'\left(\frac{P_t^{ik*}}{P_t^{k*}}\right) \Phi_t^{ik} \frac{P_t^{ik*}}{P_t^{k*}} \left(1 + \frac{\partial \ln \mu_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)}\right)$$

so

$$\frac{\partial \ln Q_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)} = \frac{Q_t^k d'\left(\frac{P_t^{ik*}}{P_t^{k*}}\right) \Phi_t^{ik} \frac{P_t^{ik*}}{P_t^{k*}}}{Q_t^{ik}} \left(1 + \frac{\partial \ln \mu_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)}\right)$$

and
$$\frac{\partial \ln Q_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)} = \theta_t^{ik} \left(1 + \frac{\partial \ln \mu_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)}\right)$$

Let
$$\eta_{Q,1+T} = \frac{\partial \ln Q_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)}$$

and

$$\eta_{\mu,1+T} = \frac{\partial \ln \mu_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)}$$

so

$$\eta_{Q,1+T} = \theta_t^{ik} \left(1 + \eta_{\mu,1+T}\right)$$

B.2 Endogenous customer base

As before assume that demand is

$$Q_t^{ik} = Q_t^k d \left(\frac{\left(1 + T_t^{ik}\right) B^k \mu_t^{ik} C_t^i}{RER_t^k} \right) \Phi_t^{ik}$$

Now we allow Φ_t^{ik} as well as μ_t^{ik} to depend on RER_t^k and $\left(1 + T_t^{ik}\right)$. Rewriting:

$$\exp\left(\ln Q_t^{ik}\right) = Q_t^k d \left(\frac{\exp\left(\ln\left(1 + T_t^{ik}\right)\right) B^k \exp\left(\ln \mu_t^{ik}\right) C_t^i}{\exp\left(\ln RER_t^k\right)} \right) \exp\left(\ln \Phi_t^{ik}\right)$$

So

$$\frac{\partial \ln Q_t^{ik}}{\partial \ln RER_t^k} Q_t^{ik} = Q_t^k d' \left(\frac{P_t^{ik*}}{P_t^{k*}} \right) \Phi_t^{ik} \frac{P_t^{ik*}}{P_t^{k*}} \left(\frac{\partial \ln \mu_t^{ik}}{\partial \ln RER_t^k} - 1 \right) + Q_t^{ik} \frac{\partial \ln \Phi_t^{ik}}{\partial \ln RER_t^k}$$

and

$$\frac{\partial \ln Q_t^{ik}}{\partial \ln RER_t^k} = \theta_t^{ik} \left(\frac{\partial \ln \mu_t^{ik}}{\partial \ln RER_t^k} - 1 \right) + \frac{\partial \ln \Phi_t^{ik}}{\partial \ln RER_t^k}$$

Let

$$\eta_{\Phi,RER} = \frac{\partial \ln \Phi_t^{ik}}{\partial \ln RER_t^k}$$

Then we can write

$$\eta_{Q,RER} = \theta_t^{ik} \left(\eta_{\mu,RER} - 1\right) + \eta_{\Phi,RER}$$

Similarly

$$\frac{\partial \ln Q_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)} Q_t^{ik} = Q_t^k d' \left(\frac{P_t^{ik*}}{P_t^{k*}} \right) \Phi_t^{ik} \frac{P_t^{ik*}}{P_t^{k*}} \left(1 + \frac{\partial \ln \mu_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)} \right) + Q_t^{ik} \frac{\partial \ln \Phi_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)}$$

so

$$\frac{\partial \ln Q_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)} = \theta_t^{ik} \left(1 + \frac{\partial \ln \mu_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)} \right) + \frac{\partial \ln \Phi_t^{ik}}{\partial \ln \left(1 + T_t^{ik}\right)}$$

Let

$$\eta_{\Phi,1+T} = \frac{\partial \ln \Phi_t^{ik}}{\partial \ln 1 + T_t^{ik}}$$

Then we can write

$$\eta_{Q,1+T} = \theta_t^{ik}\left(1+\eta_{\mu,1+T}\right) + \eta_{\Phi,1+T}$$

B.3 Iceberg trade costs depend on real exchange rates

As before assume that demand is given by:

$$Q_t^{ik} = Q_t^k d\left(\frac{\left(1+T_t^{ik}\right)B_t^k \mu_t^{ik} C_t^i}{RER_t^k}\right)\Phi_t^{ik}$$

but now allow the iceberg costs B_t^k to depend on RER_t^k but not $\left(1+T_t^{ik}\right)$. Rewriting:

$$\exp\left(\ln Q_t^{ik}\right) = Q_t^k d\left(\frac{\exp\left(\ln\left(1+T_t^{ik}\right)\right)\exp\left(\ln B_t^k\right)\exp\left(\ln \mu_t^{ik}\right)C_t^i}{\exp\left(\ln RER_t^k\right)}\right)\exp\left(\ln \Phi_t^{ik}\right)$$

So

$$\frac{\partial \ln Q_t^{ik}}{\partial \ln RER_t^k}Q_t^{ik} = Q_t^k d'\left(\frac{P_t^{ik*}}{P_t^{k*}}\right)\Phi_t^{ik}\frac{P_t^{ik*}}{P_t^{k*}}\left(\frac{\partial \ln B_t^k}{\partial \ln RER_t^k} + \frac{\partial \ln \mu_t^{ik}}{\partial \ln RER_t^k} - 1\right) + Q_t^{ik} d\frac{\partial \ln \Phi_t^{ik}}{\partial \ln RER_t^k}$$

and

$$\frac{\partial \ln Q_t^{ik}}{\partial \ln RER_t^k} = \theta_t^{ik}\left(\frac{\partial \ln B_t^k}{\partial \ln RER_t^k} + \frac{\partial \ln \mu_t^{ik}}{\partial \ln RER_t^k} - 1\right) + \frac{\partial \ln \Phi_t^{ik}}{\partial \ln RER_t^k}$$

Let

$$\eta_{B,RER} = \frac{\partial \ln B_t^k}{\partial \ln RER_t^k}$$

Then we can write:

$$\eta_{Q,RER} = \theta_t^{ik}\left(\eta_{B,RER} + \eta_{\mu,RER} - 1\right) + \eta_{\Phi,RER}$$

B.4 Additive distribution / trade costs

Suppose that there is an additive trade cost B_t^{k*}, expressed in foreign currency:

$$Q_t^{ik} = Q_t^k d\left(\frac{\left(1+T_t^{ik}\right)\frac{P_t^{ik}}{E_t^k} + B_t^{k*}}{P_t^{k*}}\right)\Phi_t^{ik}$$

Then we can write

$$\exp\left(\ln Q_t^{ik}\right) = Q_t^k d\left(\frac{\exp\left(\ln\left(1+T_t^{ik}\right)\right)\frac{\exp\left(\ln\mu_t^{ik}\right)C_t^i}{\exp\left(\ln E_t^k\right)} + \exp\left(\ln B_t^{k*}\right)}{P_t^{k*}}\right)\exp\left(\ln\Phi_t^{ik}\right)$$

so

$$\frac{\partial\ln Q_t^{ik}}{\partial\ln E_t^k}Q_t^{ik} = \begin{array}{c} Q_t^k d'\left(\frac{\left(1+T_t^{ik}\right)\frac{P_t^{ik}}{E_t^k}+B_t^{k*}}{P_t^{k*}}\right)\Phi_t^{ik}\left[\frac{\left(1+T_t^{ik}\right)\frac{P_t^{ik}}{E_t^k}}{P_t^{k*}}\left(\frac{\partial\ln\mu_t^{ik}}{\partial\ln E_t^k}-1\right)+\frac{B_t^{k*}}{P_t^{k*}}\frac{\partial\ln B_t^{k*}}{\partial\ln E_t^k}\right] \\ +Q_t^{ik}\frac{\partial\ln\Phi_t^{ik}}{\partial\ln E_t^k} \end{array}$$

and

$$\frac{\partial\ln Q_t^{ik}}{\partial\ln E_t^k} = \theta_t^{ik}\left[\frac{\left(1+T_t^{ik}\right)\frac{P_t^{ik}}{E_t^k}}{\left(1+T_t^{ik}\right)\frac{P_t^{ik}}{E_t^k}+B_t^{k*}}\left(\frac{\partial\ln\mu_t^{ik}}{\partial\ln E_t^k}-1\right)+\frac{B_t^{k*}}{\left(1+T_t^{ik}\right)\frac{P_t^{ik}}{E_t^k}+B_t^{k*}}\frac{\partial\ln B_t^{k*}}{\partial\ln E_t^k}\right]+\frac{\partial\ln\Phi_t^{ik}}{\partial\ln E_t^k}$$

Define

$$1+b_t^{ik} = \frac{\left(1+T_t^{ik}\right)\frac{P_t^{ik}}{E_t^k}+B_t^{k*}}{\left(1+T_t^{ik}\right)\frac{P_t^{ik}}{E_t^k}}$$

and we have

$$\frac{\partial\ln Q_t^{ik}}{\partial\ln E_t^k} = \theta_t^{ik}\left[\frac{1}{1+b_t^{ik}}\left(\frac{\partial\ln\mu_t^{ik}}{\partial\ln E_t^k}-1\right)+\frac{b_t^{ik}}{1+b_t^{ik}}\frac{\partial\ln B_t^{k*}}{\partial\ln E_t^k}\right]+\frac{\partial\ln\Phi_t^{ik}}{\partial\ln E_t^k}$$

Now if B_t^{k*} is fully incurred in the foreign market, $\partial\ln B_t^{k*}/\partial\ln E_t^k = 0$, while if B_t^{k*} is fully incurred in the domestic market, $\partial\ln B_t^{k*}/\partial\ln E_t^k = -1$. If B_t^{k*} is Cobb-Douglas in foreign and domestic components, with weight $\omega_E \in [0,1]$ on the domestic component, we have:

$$\eta_{Q,E} = \frac{\theta_t^{ik}}{1+b_t^{ik}}\left(\eta_{\mu,E}-1-\omega_E b_t^{ik}\right)+\eta_{\Phi,E}$$

Similarly

$$\frac{\partial\ln Q_t^{ik}}{\partial\ln\left(1+T_t^{ik}\right)}Q_t^{ik} = \begin{array}{c} Q_t^k d'\left(\frac{\left(1+T_t^{ik}\right)\frac{P_t^{ik}}{E_t^k}+B_t^{k*}}{P_t^{k*}}\right)\Phi_t^{ik}\left[\frac{\left(1+T_t^{ik}\right)\frac{P_t^{ik}}{E_t^k}}{P_t^{k*}}\left(1+\frac{\partial\ln\mu_t^{ik}}{\partial\ln\left(1+T_t^{ik}\right)}\right)+\frac{B_t^{k*}}{P_t^{k*}}\frac{\partial\ln B_t^{k*}}{\partial\ln\left(1+T_t^{ik}\right)}\right] \\ +Q_t^{ik}\frac{\partial\ln\Phi_t^{ik}}{\partial\ln\left(1+T_t^{ik}\right)} \end{array}$$

so

$$\frac{\partial \ln Q_t^{ik}}{\partial \ln\left(1+T_t^{ik}\right)} = \theta_t^{ik}\left[\frac{1}{1+b_t^{ik}}\left(1+\frac{\partial \ln \mu_t^{ik}}{\partial \ln\left(1+T_t^{ik}\right)}\right)+\frac{b_t^{ik}}{1+b_t^{ik}}\frac{\partial \ln B_t^{k*}}{\partial \ln\left(1+T_t^{ik}\right)}\right]+\frac{\partial \ln \Phi_t^{ik}}{\partial \ln\left(1+T_t^{ik}\right)}$$

How B_t^{k*} depends on tariffs is a function of whether tariffs are levied on the f.o.b. or c.i.f. value, and whether B_t^{k*} is purely an international shipping cost, or also includes distribution costs inside the export market. Note that while the US levies tariffs on the f.o.b. value, most countries levy them on the c.i.f. value, so B_t^{k*} would be increasing in shipping costs, with an elasticity of 1 if there are no local distribution costs. Allowing $\partial \ln B_t^{k*}/\partial \ln\left(1+T_t^{ik}\right) = \omega_T \in [0,1]$, we get:

$$\eta_{Q,1+T} = \frac{\theta_t^{ik}}{1+b_t^{ik}}\left(1+\eta_{\mu,1+T}+\omega_T b_t^{ik}\right)+\eta_{\Phi,1+T}$$

Combining the expressions for $\eta_{Q,E}$ and $\eta_{Q,1+T}$, we obtain:

$$\frac{\theta_t^{ik}}{1+b_t^{ik}} = \frac{\eta_{Q,E}-\eta_{\Phi,E}}{\eta_{\mu,E}-1-\omega_E b_t^{ik}} = \frac{\eta_{Q,1+T}-\eta_{\Phi,1+T}}{1+\eta_{\mu,1+T}+\omega_T b_t^{ik}}$$

Setting $\eta_{Q,E}$, $\eta_{\mu,E}$, $\eta_{Q,1+T}$ and $\eta_{\mu,1+T}$ equal to their values in Appendix Table 20 where we split up the real exchange rate into nominal exchange rates and the foreign CPI, and fixing $\eta_{\Phi,E} = \eta_{\Phi,1+T} = 0$ and rearranging, we obtain:

$$b_t^{ik} = \frac{(2.31 * 0.77)-(0.35 * 1.01)}{0.35\omega_T - 2.31\omega_E} = \frac{1.425}{0.35\omega_T - 2.31\omega_E}$$

b_t^{ik} is minimized when $\omega_E = 0$ and $\omega_T = 1$: this yields $b_t^{ik} = 4.072$. This is the value of b_t^{ik} which can reconcile our estimated elasticities of exports with respect to nominal exchange rates and tariffs. This value of b_t^{ik} implies that more than 80% of the consumer price of imports is accounted for by international shipping costs. This seems too large to be plausible.

Several authors (e.g. Burstein, Neves and Rebelo (2003) and Corsetti and Dedola (2005)) propose distribution costs as a potential explanation for the insensitivity of exports to exchange rates. They model distribution costs by assuming that each unit of a traded good must be bundled with η units of a nontraded good in the destination market in order for consumers to consume. This is equivalent to an additive trade cost where $\omega_E = \omega_T = 0$. So while a high distribution cost share can reconcile a low quantity elasticity with respect to the exchange rate with a price elasticity of demand that is greater than 1, no matter what the distribution cost share, distribution costs which take this form cannot rationalize the very different elasticities of quantities with respect to exchange rates and tariffs.

C Price elasticity of demand estimates based on delta method

The price elasticity of demand is a nonlinear function of random variables:

$$\theta_t^{ik} = \frac{\eta_{Q_t^{ik},RER_t^k}}{\eta_{\mu_t^{ik},RER_t^k} - 1}$$

and similarly for tariffs. To use the delta method to calculate the mean and standard deviation of θ_t^{ik}, we need to take a stand on the covariance of the two elasticities. We do not estimate this covariance, but based on the fact that the correlation must lie in the range $[-1, 1]$, we can calculate a range of different means and standard deviations. The table below reports the means and standard deviations for correlations equal to $\{-1, 0, 1\}$:

Table 14: Price elasticity of demand using Delta method

$\rho(\eta_Q, \eta_P)$	-1	0	1
Variation		rer_t^k	
$\mu(\theta_t^{ik})$	-0.42	-0.42	-0.43
$\sigma(\theta_t^{ik})$	0.09	0.11	0.13
Variation		τ_t^{jk}	
$\mu(\theta_t^{ik})$	-2.65	-2.98	-3.31
$\sigma(\theta_t^{ik})$	0.24	1.32	1.85

D Additional quantitative results

D.1 Macro shocks: robustness on ϕ

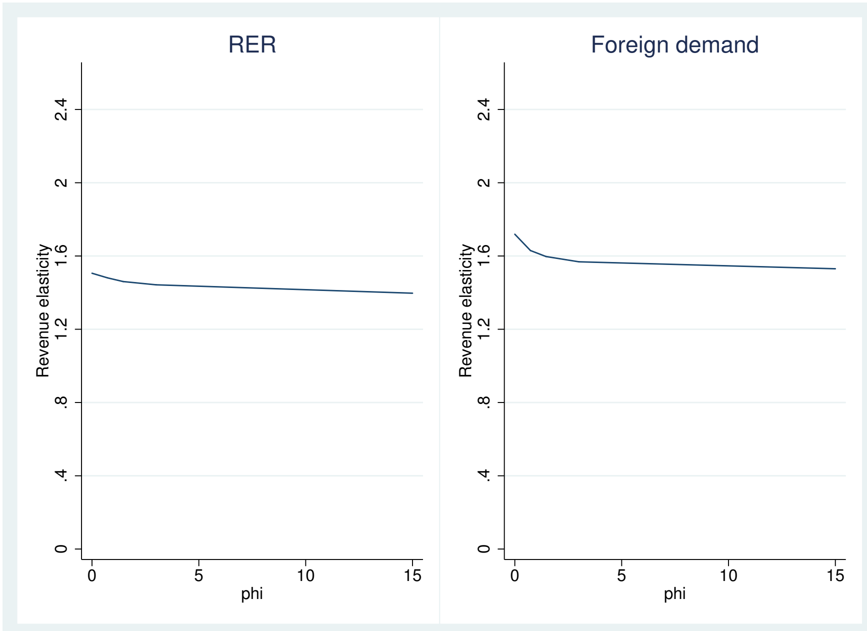

Figure 1: Revenue elasticities and ϕ

Notes: Elasticities are evaluated at baseline values of ρ, α and δ, for case of investment in foreign currency, prices sticky in foreign currency.

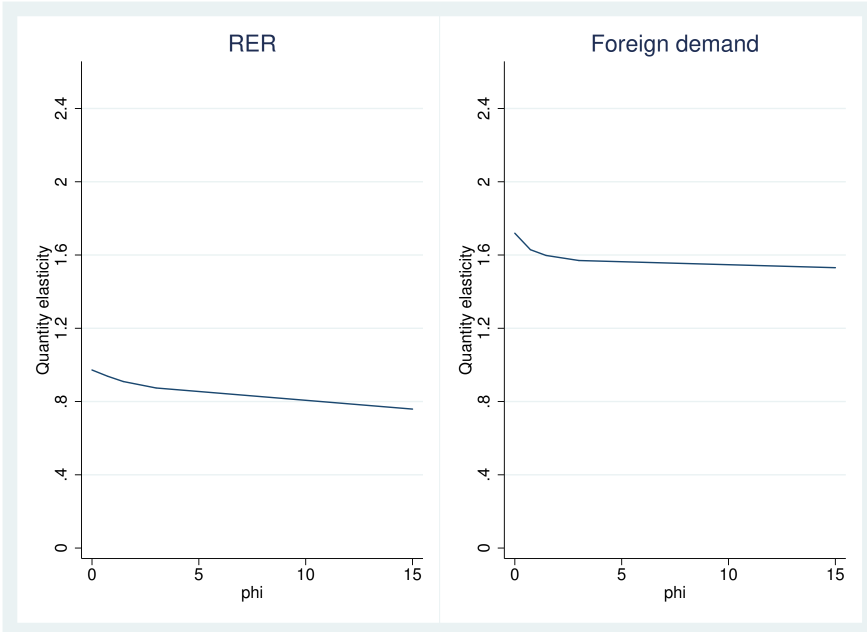

Figure 2: Quantity elasticities and ϕ

Notes: Elasticities are evaluated at baseline values of ρ, α and δ, for case of investment in foreign currency, prices sticky in foreign currency.

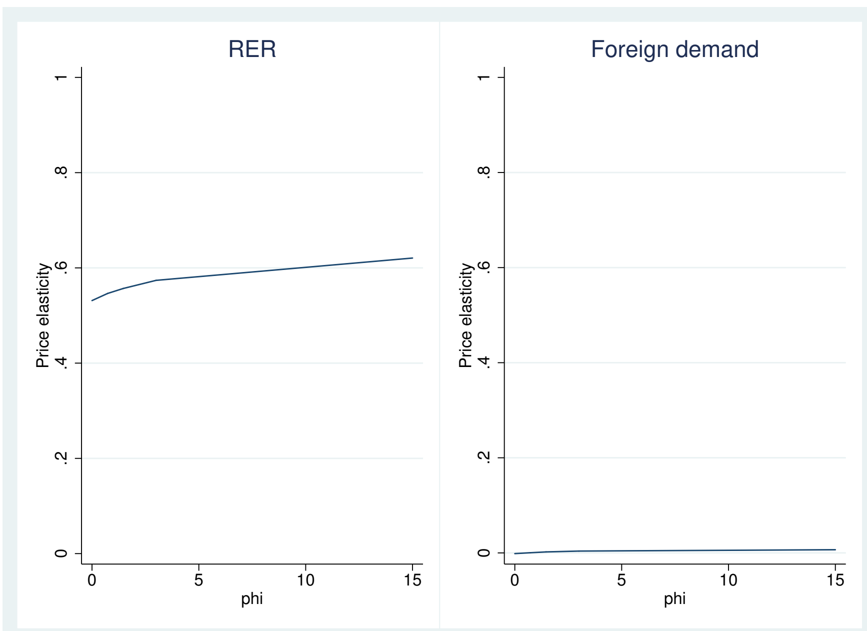

Figure 3: Price elasticities and ϕ

Notes: Elasticities are evaluated at baseline values of ρ, α and δ, for case of investment in foreign currency, prices sticky in foreign currency.

D.2 Macro shocks: robustness on ρ

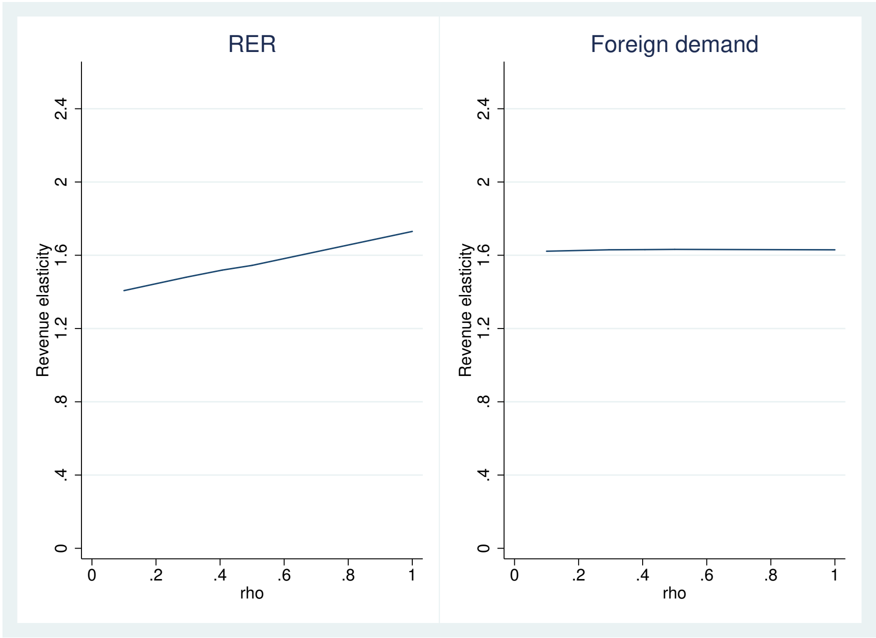

Figure 4: Revenue elasticities and ρ

Notes: Elasticities are evaluated at baseline values of ϕ, α and δ, for case of investment in foreign currency, prices sticky in foreign currency.

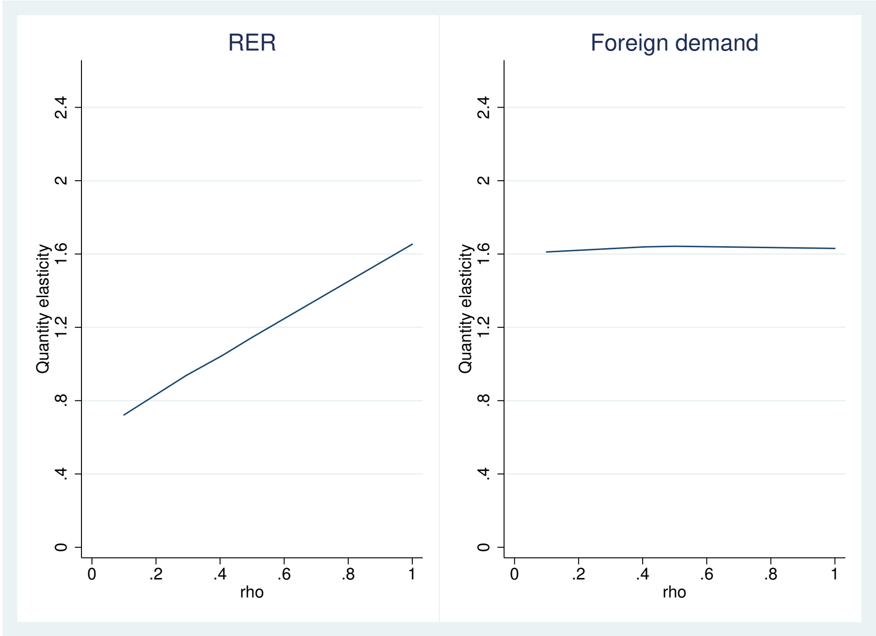

Figure 5: Quantity elasticities and ρ

Notes: Elasticities are evaluated at baseline values of ϕ, α and δ, for case of investment in foreign currency, prices sticky in foreign currency.

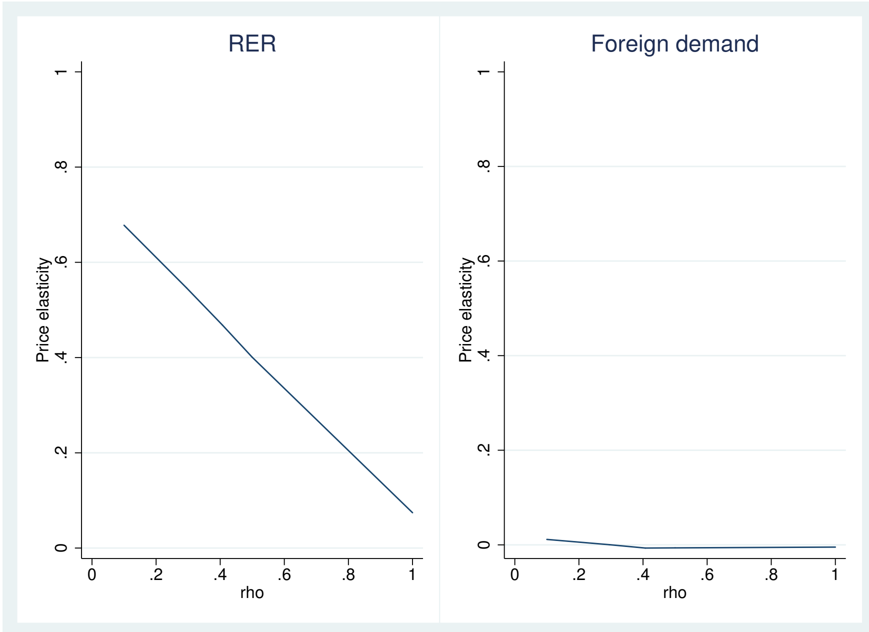

Figure 6: Price elasticities and ρ

Notes: Elasticities are evaluated at baseline values of ϕ, α and δ, for case of investment in foreign currency, prices sticky in foreign currency.

D.3 Macro shocks: robustness on α

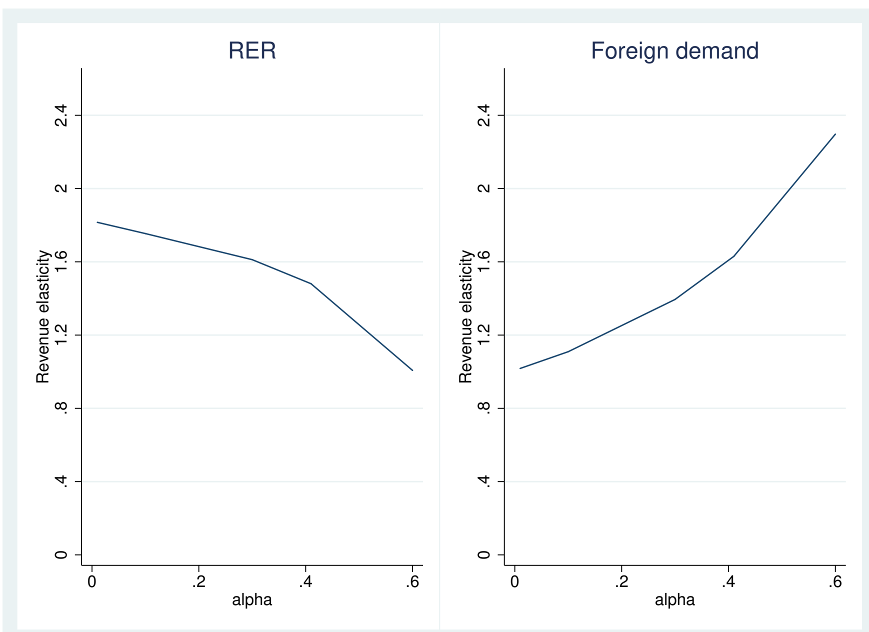

Figure 7: Revenue elasticities and α

Notes: Elasticities are evaluated at baseline values of ϕ, ρ and δ, for case of investment in foreign currency, prices sticky in foreign currency.

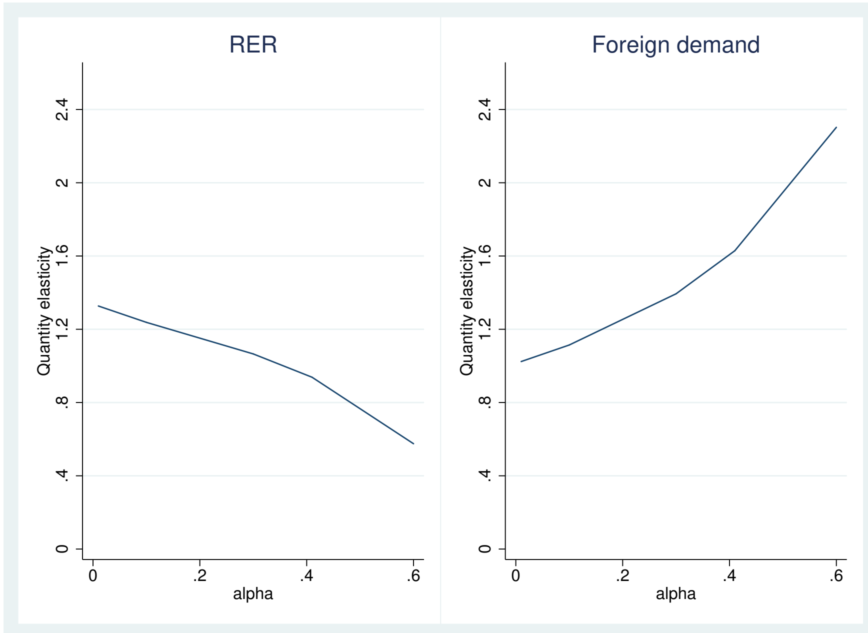

Figure 8: Quantity elasticities and α

Notes: Elasticities are evaluated at baseline values of ϕ, ρ and δ, for case of investment in foreign currency, prices sticky in foreign currency.

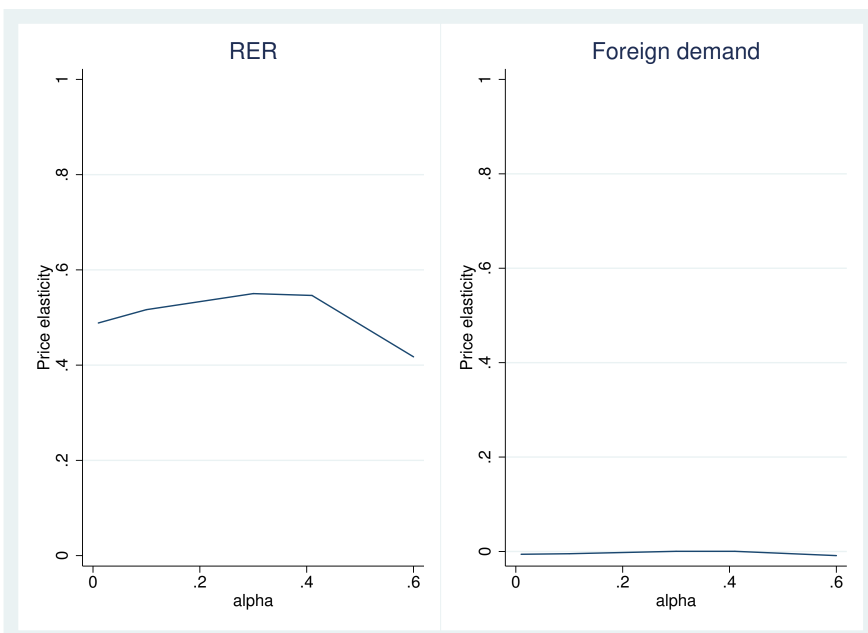

Figure 9: Price elasticities and α

Notes: Elasticities are evaluated at baseline values of ϕ, ρ and δ, for case of investment in foreign currency, prices sticky in foreign currency.

D.4 Macro shocks: robustness on δ

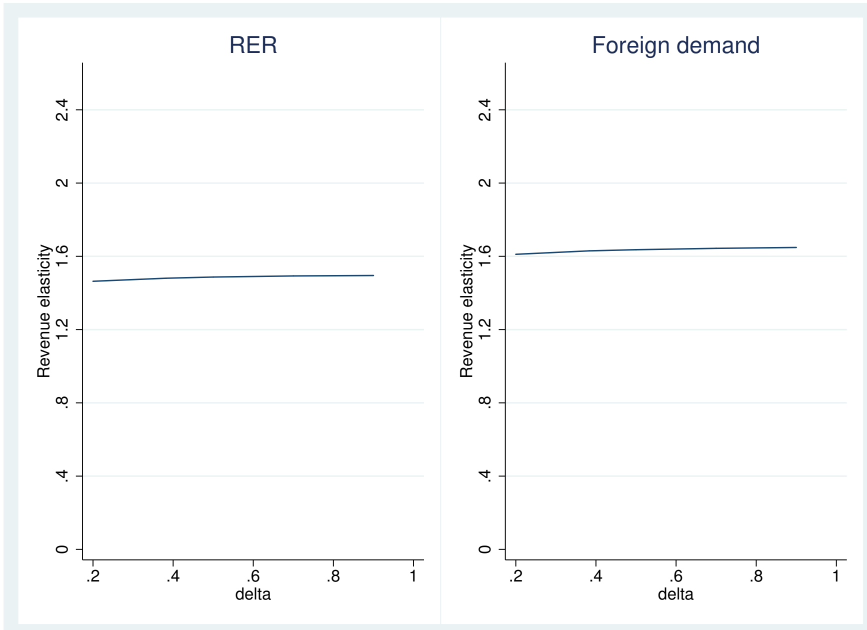

Figure 10: Revenue elasticities and δ

Notes: Elasticities are evaluated at baseline values of ϕ, ρ and α, for case of investment in foreign currency, prices sticky in foreign currency.

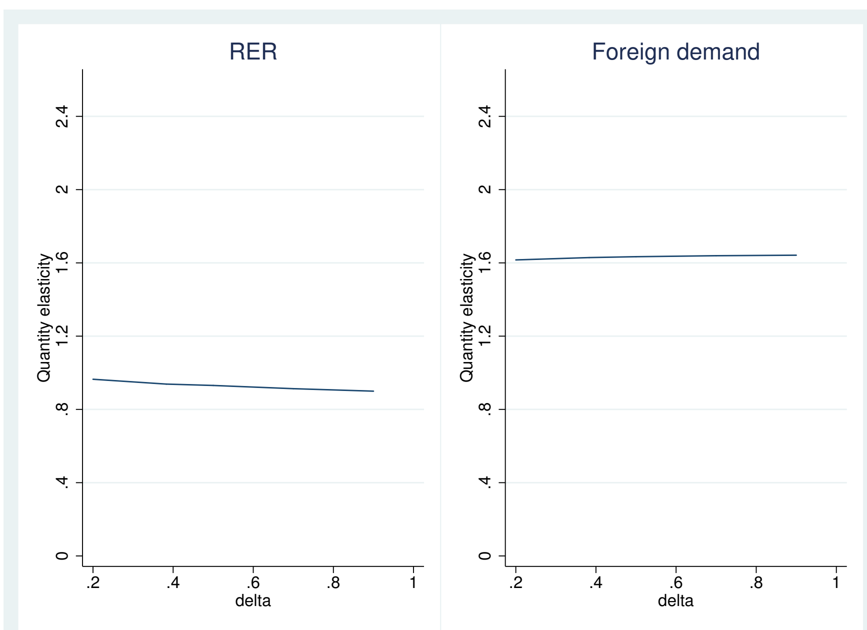

Figure 11: Quantity elasticities and δ

Notes: Elasticities are evaluated at baseline values of ϕ, ρ and α, for case of investment in foreign currency, prices sticky in foreign currency.

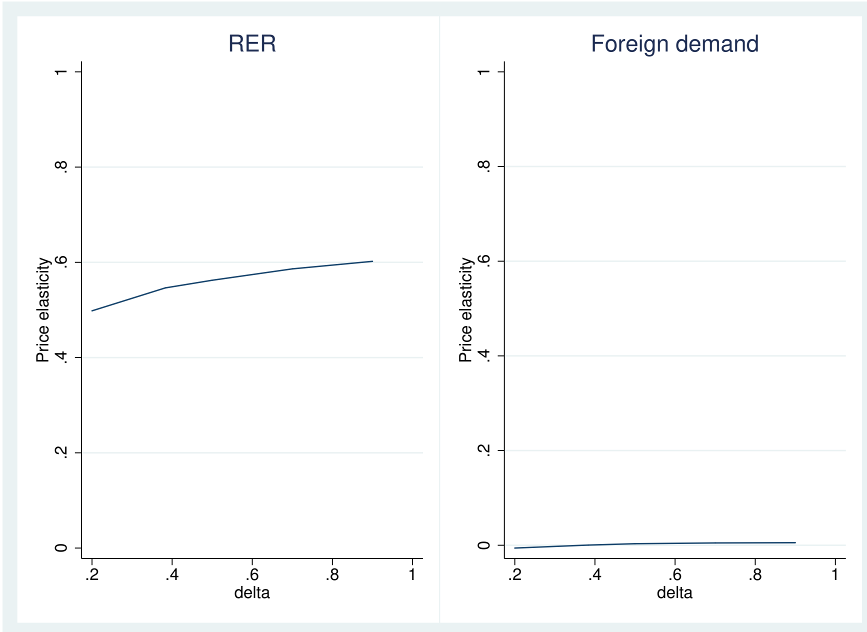

Figure 12: Price elasticities and δ

Notes: Elasticities are evaluated at baseline values of ϕ, ρ and α, for case of investment in foreign currency, prices sticky in foreign currency.

D.5 Tariff shocks: robustness on ϕ

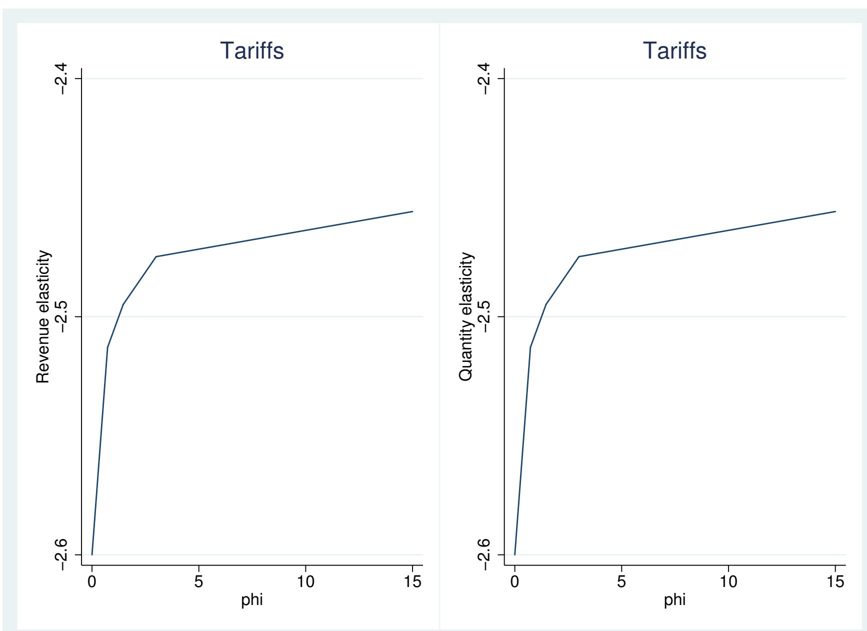

Figure 13: Elasticities with respect to tariffs and ϕ

Notes: Elasticities are evaluated at baseline values of δ and α, with flexible prices

D.6 Tariff shocks: robustness on α

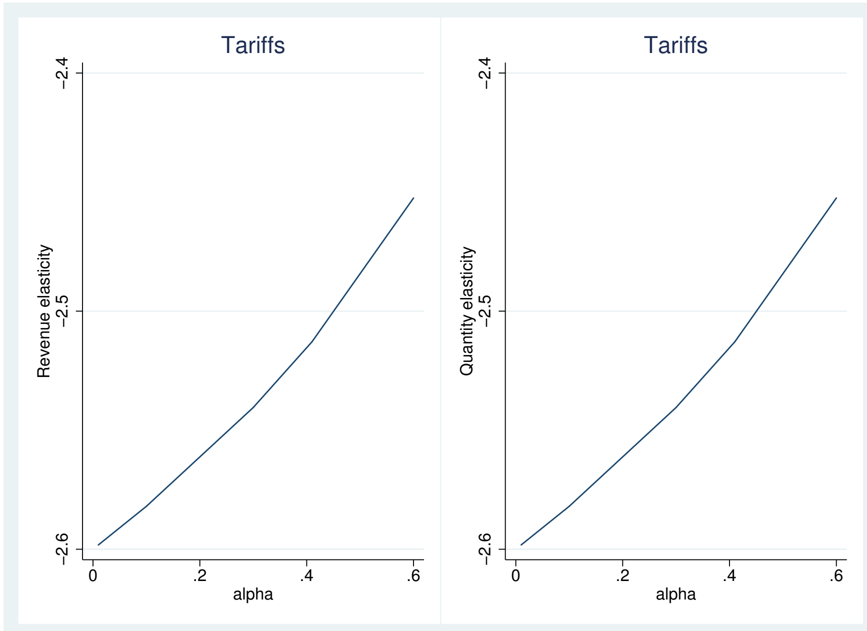

Figure 14: Elasticities with respect to tariffs and α

Notes: Elasticities are evaluated at baseline values of ϕ and δ, with flexible prices

D.7 Tariff shocks: robustness on δ

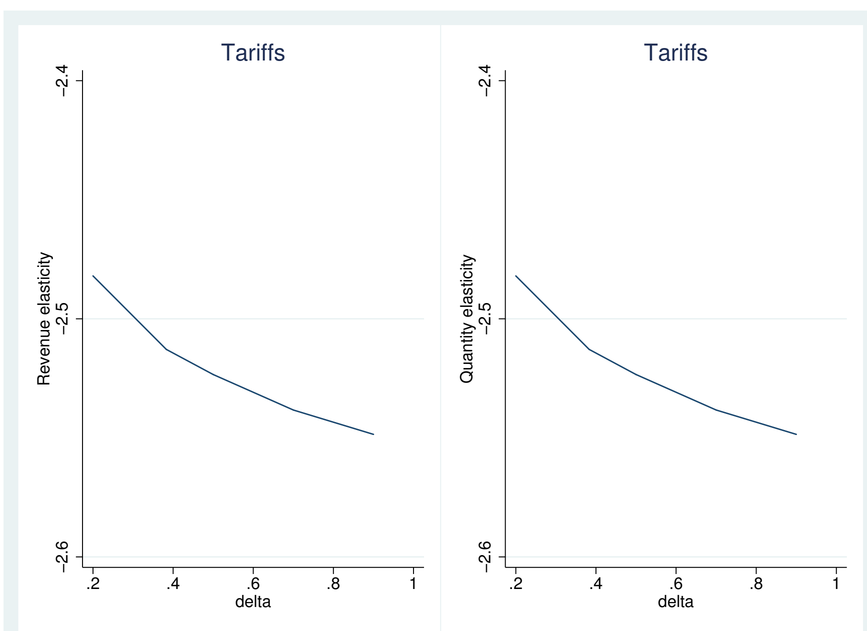

Figure 15: Elasticities with respect to tariffs and δ

Notes: Elasticities are evaluated at baseline values of ϕ and α, with flexible prices