Exporters and Shocks

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CAED, 26-28 April 2012

Motivation: International Elasticity Puzzle

- Expenditure-switching effect of exchange rate changes "small"
- Trade-expanding effects of tariff liberalizations "large"
- In the absence of frictions, both responses governed by same elasticity of substitution
- Can frictions interacting with different shock processes explain the fact that these responses are different?
  - e.g. Ruhl (2008) emphasizes differential persistence of shocks and sunk costs of exporting
- What does micro data have to say about this and related explanations?

What we do & what we find

- Use micro data for Ireland to estimate firm-level elasticities of export revenue, entry, and exit to macro shocks and tariff liberalizations
  - Allow for costs of adjustment on demand as well as sunk costs of entry
  - Use *within-firm-year* variation in responses to shocks across different export markets to identify elasticities

- International Elasticity Puzzle not due solely to entry and exit
- Elasticities of firm-level export revenue with respect to shocks are close to aggregate elasticities
- Entry and exit more responsive to tariffs than real exchange rates, but entrants/exiters are small

Data: Matched firm census & customs data

- Annual enterprise census for Ireland, 2000-2009: all plants in mining & manufacturing with ≥ 3 persons engaged
- Usual set of firm census variables: sales, employment, wage bill, investment, materials, expenditures etc.

- Customs records, 2000-2009 (Intrastat and Extrastat)
- Records matched to *firms* using tax id and where necessary, confidential info, by CSO
- Annual euro value of exports at 8-digit CN level, by firm-destination (6-digit corresponds to HS6)
- Important: Intrastat export reporting threshold (Euro 635,000 annually) is higher than Extrastat export reporting threshold (Euro 254 per transaction)

Data: Tariffs

- WTO: Data on ad valorem MFN tariffs aggregated to the HS6 level (unweighted mean)
- 2000-2004: Tariff reductions agreed under the Uruguay Round
- Construct firm-market-year-specific tariff variables for US, Canada, Australia, Japan (20-25% of Irish exports)
- Two tariff variables:
  - Entry and exit:

$$tau\left(entry, exit\right)_t^{ik} = \sum_m s_t^i\left(m\right) \ln\left(1+\tau_t^k\left(m\right)\right)$$

  - Sales:

$$tau\left(sales\right)_t^{ik} = \sum_m s_t^{ik}\left(m\right) \ln\left(1+\tau_t^k\left(m\right)\right)$$

  - $s_t^i\left(m\right)$: share of m in i's exports at t
  - $s_t^{ik}\left(m\right)$: share of m in i's exports to k at t

Data: Macro shocks

- Annual average real consumption exchange rate (Source: IFS)
- Real aggregate demand in local currency (Source: IFS/OECD)
  - Nominal expenditure (GDP - Exports + Imports) deflated by destination market CPI

Summary statistics: HS6 tariffs

Tariff variation over time and across countries

	Australia		Canada		Japan		US	
const	4.41	(0.02)**	4.29	(0.01)**	3.37	(0.01)**	3.98	(0.01)**
2001	-0.28	(0.02)**	-0.11	(0.02)**	-0.09	(0.01)**	-0.02	(0.01)**
2002	-0.28	(0.02)**	-0.27	(0.02)**	-0.16	(0.01)**	-0.12	(0.01)**
2003	-0.28	(0.02)**	-0.39	(0.02)**	-0.24	(0.01)**	-0.21	(0.01)**
2004	-0.28	(0.02)**	-0.45	(0.02)**	-0.32	(0.01)**	-0.28	(0.01)**
2005	-0.98	(0.02)**	-0.65	(0.02)**	-0.30	(0.01)**	-0.38	(0.01)**
2006	-0.98	(0.02)**	-0.65	(0.02)**	-0.34	(0.01)**	-0.38	(0.01)**
2007	-0.97	(0.02)**	-0.67	(0.02)**	-0.36	(0.01)**	-0.37	(0.01)**
2008	-0.97	(0.02)**	-0.67	(0.02)**	-0.36	(0.01)**	-0.37	(0.01)**
2009	-0.97	(0.02)**	-0.79	(0.02)**	-0.36	(0.01)**	-0.38	(0.01)**
hs6 f.e.	yes		yes		yes		yes	
R^2	0.96		0.98		0.99		1.00	
N	51444		511124		51036		48324	

Notes: Dependent variable is unweighted average ad valorem tariff at the HS6 level. HS6 codes with only positive specific or mixed tariffs are excluded.

Summary statistics: real exchange rates

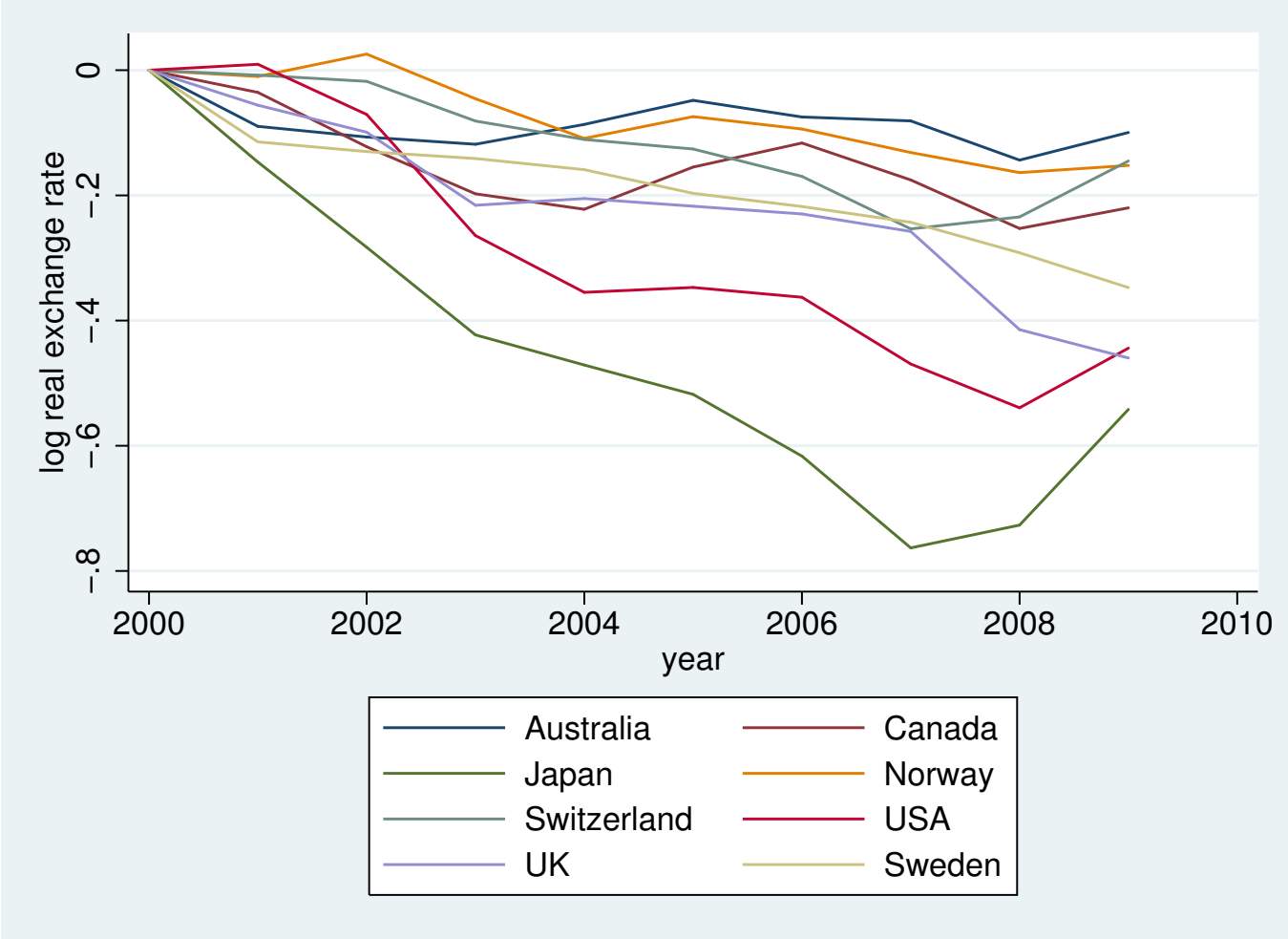

Figure: Annual average real exchange rates: Non-Euro destinations

Empirical strategy: Export revenue

- Condition on current and lagged participation in home market
- Approximate growth rate of euro revenue, deflated by Irish CPI, as follows

$$\Delta r_t^{ik} = \alpha^k + c_t^i + \gamma' \mathbf{a}_{t-1}^{ik} + \beta' \Delta \mathbf{z}_t^{ik} + \varepsilon_t^{ik}$$

- α^k: market fixed effect
- c_t^i: firm-year fixed effect
- $\mathbf{a}_{t-1}^{ik}$: vector of indicators for age-in-market
- $\Delta \mathbf{z}_t^{ik}$: vector of shocks: log changes in real exchange rate, real demand, tariff
- Markets: 18 markets - Euro 9, UK, Sweden, Denmark, Norway, Switzerland, Australia, Canada, Japan, US
- Selection bias: Focus on observations likely to be far from entry/exit thresholds: firm-market pairs with positive sales in all years 2000-2009

Empirical strategy: Entry

- Focus on firm-years "at risk" for entry: $X_{t-1}^{ik} = 0$
- Condition on current and lagged participation at home
- Approximate probability of entry as follows:

$$\Pr\left[X_t^{ik} = 1\right] = \alpha^k + c_t^i + \beta \mathbf{z}_t^{ik} + \gamma' \left(\mathbf{s}_{t-1}^i \otimes \mathbf{z}_t^{ik}\right) + \varepsilon_t^{ik}$$

- α^k: market fixed effect
- c_t^i: firm-year fixed effect
- $\mathbf{z}_t^{ik}$: vector of shocks: log real exchange rate, real demand, tariff
- $\mathbf{s}_{t-1}^i$: vector of "cost" variables: indicators for employment

Empirical strategy: Exit

- Focus on firm-years "at risk" for exit: $X_{t-1}^{ik} = 1$
- Condition on current and lagged participation at home
- Approximate probability of exit as follows:

$$\Pr\left[X_t^{ik} = 0\right] = \begin{array}{c} \alpha^k + c_t^i + \lambda' \mathbf{d}_t^{ik} + \beta' \mathbf{z}_t^{ik} + \\ \gamma' \left(\mathbf{s}_{t-1}^i \otimes \mathbf{z}_t^{ik}\right) + \rho' \left(\mathbf{d}_t^{ik} \otimes \mathbf{z}_t^{ik}\right) + \varepsilon_t^{ik} \end{array}$$

- α^k: market fixed effect
- c_t^i: firm-year fixed effect
- $\mathbf{d}_{t-1}^{ik}$: controls for market-k experience: lagged log revenue from market k
- $\mathbf{z}_t^{ik}$: vector of shocks: log real exchange rate, real demand, tariff
- $\mathbf{s}_{t-1}^i$: vector of "cost" variables: indicators for employment

Results: Export revenue

Destinations	All			
Ownership	All		Irish-owned	
	coeff	s.e.	coeff	s.e.
Δrer_t^k	0.84	(0.31)**	0.91	(0.44)**
Δdem_t^k	2.18	(0.68)**	2.34	(0.91)**
Δtau_t^{ik}	-5.48	(2.48)**	-5.73	(3.11)*
Market f.e.	yes		yes	
Firm-year f.e.	yes		yes	
# firm-mkt-years	13614		7612	
# firm-years	3602		2438	
R^2	0.34		0.41	
R^2-adj	0.10		0.13	

Notes: Estimation method is OLS. Dependent variable is log euro sales deflated by Irish CPI. Sample consists of firm-market pairs with continuous participation 2000-2009. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance
at the 10% level.

Results: Entry

Destinations	Extrastat only				All			
Ownership	All		Irish-owned		All		Irish-owned	
	coeff	s.e.	coeff	s.e.	coeff	s.e.	coeff	s.e.
rer_t^k	0.04	(0.02)**	0.07	(0.02)**	0.02	(0.01)**	0.02	(0.01)**
$emp2_{t-1}^i * rer_t^k$	-0.01	(0.00)**	-0.01	(0.00)**	0.00	(0.00)**	0.00	(0.00)**
$emp3_{t-1}^i * rer_t^k$	-0.01	(0.01)**	-0.02	(0.01)**	0.00	(0.00)**	0.00	(0.00)
dem_t^k	0.03	(0.01)**	0.02	(0.01)	0.01	(0.00)*	0.01	(0.00)**
$emp2_{t-1}^i * dem_t^k$	-0.01	(0.00)**	-0.01	(0.00)**	0.00	(0.00)**	0.00	(0.00)*
$emp3_{t-1}^i * dem_t^k$	-0.01	(0.00)**	-0.02	(0.00)**	0.00	(0.00)**	0.00	(0.00)
tau_t^{ik}	0.35	(0.09)**	0.30	(0.10)**	0.54	(0.07)**	0.52	(0.07)**
$emp2_{t-1}^i * tau_t^{ik}$	-0.20	(0.10)**	-0.18	(0.10)	-0.59	(0.07)**	-0.56	(0.08)**
$emp3_{t-1}^i * tau_t^{ik}$	-0.35	(0.10)**	-0.28	(0.11)**	-0.90	(0.08)**	-0.89	(0.09)**
Market f.e.	yes		yes		yes		yes	
Firm-year f.e.	yes		yes		yes		yes	
# firm-mkt-years	94698		84692		498810		459684	
# firm-years	35675		32919		35807		32962	
# firms	7555		7071		7565		7073	
R^2	0.36		0.33		0.25		0.21	
R^2-adj	-0.02		-0.10		0.19		0.15	

Notes: Estimation method is OLS. Sample consists of all firm-mkt-years where plant is at risk for entry and where there is positive lagged and current sales in the Irish market. Dependent variable is an indicator for entry. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.

Results: Exit

Destinations	Extrastat only				All			
Ownership	All		Irish-owned		All		Irish-owned	
	coeff	s.e.	coeff	s.e.	coeff	s.e.	coeff	s.e.
rev^{ik}_{t-1}	-0.25	(0.02)**	-0.34	(0.04)**	-0.08	(0.01)**	-0.07	(0.01)**
rer^{k}_{t}	-0.24	(0.07)**	-0.30	(0.11)**	-0.08	(0.03)**	-0.08	(0.04)*
$emp2^{i}_{t-1} * rer^{k}_{t}$	-0.00	(0.01)	0.00	(0.01)	-0.00	(0.00)	-0.00	(0.00)
$emp3^{i}_{t-1} * rer^{k}_{t}$	-0.02	(0.01)	-0.01	(0.02)	0.00	(0.00)	0.01	(0.00)*
$rev^{ik}_{t-1} * rer^{k}_{t}$	0.02	(0.00)**	0.02	(0.00)**	0.00	(0.00)**	0.00	(0.00)**
dem^{k}_{t}	0.31	(0.13)**	0.30	(0.20)	0.08	(0.05)	0.09	(0.08)
$emp2^{i}_{t-1} * dem^{k}_{t}$	-0.01	(0.01)	-0.00	(0.01)	-0.00	(0.01)	0.00	(0.01)
$emp3^{i}_{t-1} * dem^{k}_{t}$	-0.01	(0.01)	-0.00	(0.01)	0.00	(0.01)	0.01	(0.01)
$rev^{ik}_{t-1} * dem^{k}_{t}$	0.01	(0.00)**	0.01	(0.00)**	0.00	(0.00)**	0.00	(0.00)
tau^{ik}_{t}	-1.78	(0.69)**	-2.21	(0.80)**	-0.84	(0.52)	-1.60	(0.60)**
$emp2^{i}_{t-1} * tau^{ik}_{t}$	2.37	(0.73)**	2.00	(0.86)**	1.83	(0.52)**	2.01	(0.60)**
$emp3^{i}_{t-1} * tau^{ik}_{t}$	2.38	(0.74)**	2.55	(0.90)**	1.98	(0.55)**	2.61	(0.65)**
$rev^{ik}_{t-1} * tau^{ik}_{t}$	-0.17	(0.07)**	-0.02	(0.09)	-0.19	(0.05)**	-0.10	(0.06)
Market f.e.	yes		yes		yes		yes	
Firm-year f.e.	yes		yes		yes		yes	
# firm-mkt-years	11518		6492		38290		21524	
# firm-years	4964		3256		7521		5318	
# firms	1222		884		1582		1186	
R^2	0.61		0.67		0.43		0.47	
R^2-adj	0.32		0.33		0.29		0.29	

Notes: Estimation method is OLS. Sample consists of all firm-mkt-years where plant is at risk for exit and where there is positive lagged and current sales in the Irish market. Dependent variable is an indicator for exit. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.

Conclusions

- International Elasticity Puzzle is not due solely to export entry and exit
- Firm-level export revenue elasticities with respect to shocks are close to aggregate elasticities
- Extensive margin is more responsive to tariffs than exchange rates, but entrants/exiters are small
- Future work
  - What explains responses of continuing participants?
  - Currently exploring within-firm-product-market responses

Results: Export revenue

Revenue and EU accession

	(1)		(2)	
Destinations	Non-tariff only			
Ownership	All		Irish-owned	
	coeff	s.e.	coeff	s.e.
Δrer_t^k	0.26	(0.31)	0.31	(0.42)
Δdem_t^k	1.54	(0.54)**	2.16	(0.79)**
Δeu_t^k	0.25	(0.13)*	0.22	(0.15)
Market f.e.	yes		yes	
Firm-year f.e.	yes		yes	
# firm-mkt-years	12001		6533	
# firm-years	3079		1968	
R^2	0.33		0.36	
R^2-adj	0.10		0.08	

Notes: Estimation method is OLS. Dependent variable is log euro sales deflated by Irish CPI. Sample consists of firm-market pairs with continuous participation 2000-2009. Robust standard errors are calculated. ** indicates significance at the 5% level. * indicates significance at the 10% level.