Home Bias in International Emissions Trading: Evidence from the EU ETS

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June 18-19, 2019

Introduction

- Growing empirical literature: How well do climate-policy instruments work?
- Cap-and-trade of emissions: Dominant in EU and many other regions
- Paris Agreement: Many national markets that may be linked
- Different sources of potential inefficiency in ETS
- Among them: Transactions costs

Transactions costs in ETS

- Theory: Heterogeneous transactions costs lead to different total prices for covered firms
  - $\rightarrow$ MACs not equalized

  Stavins (1995), Montero (1997), Hahn and Stavins (2011)
- Empirics: Transactions costs are relevant in EU ETS
  - $\rightarrow$ MRV and informational costs
  - $\rightarrow$ More important for small firms

  Sandoff and Schaad (2009), Jaraite et al. (2010), Heindl (2012), Zaklan (2013), Jaraite-Kazukauske and Kazukauskas (2014)

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This paper

- Focus on international dimension of permit trading
- Use universe of allowance transactions from EU ETS, 2005-2013
- Application of gravity framework on firm level
- Identify home bias in allowance trade
- Investigate potential mechanisms

EU ETS

- 28 EU countries plus NO, LIE and ISL
- In operation since 2005
- Coverage: Firms in energy-intensive industries

EU Transactions Log (EUTL)

- Data on transactions with delay of 3 years
- Organized on the “account” level
  - Operator holding accounts (OHA): 1 account per installation
  - Person holding accounts (PHA)
  - Government accounts
- Data includes
  - Account types on both sides of trade
  - Transaction amount and date
  - Names and addresses of account holders
- Data does not include
  - Type of trade (exchange, OTS, bilateral)
  - Date of contract
  - Transaction price
- Aggregation to firm level via Orbis database

Transactions data

Start with all 436,650 individual transactions between OHAs and PHAs during 2005-2013

Focus on purchases

Drop trades if

- account holders on both sides belong to same firm
- buying account in NO, BG, or outside EU ETS
- proven fraudulent traders involved
- purchases made by BlueNext

$\Rightarrow$ 327,000 transactions involving 6,968 different firms

Data aggregation procedure

Buyer	Buyer	Buyer			Seller	Seller
Country(***bc***)	Account holder(***bh***)	Account(***ba***)	year	Purchase volum	Country(***sc***)	Account(***sa***)
Germany	xxx1	z1	2007	1000	Germany	y1
Germany	xxx1	z1	2007	1500	Germany	y1
Germany	xxx1	z2	2007	1000	Germany	y2
Germany	xxx1	z2	2007	800	Germany	y3
Germany	xxx1	z2	2007	50	France	y4
Germany	xxx1	z3	2007	300	France	y4
Germany	xxx1	z3	2007	20	Poland	y5
Germany	xxx1	z3	2007	80	Poland	y6

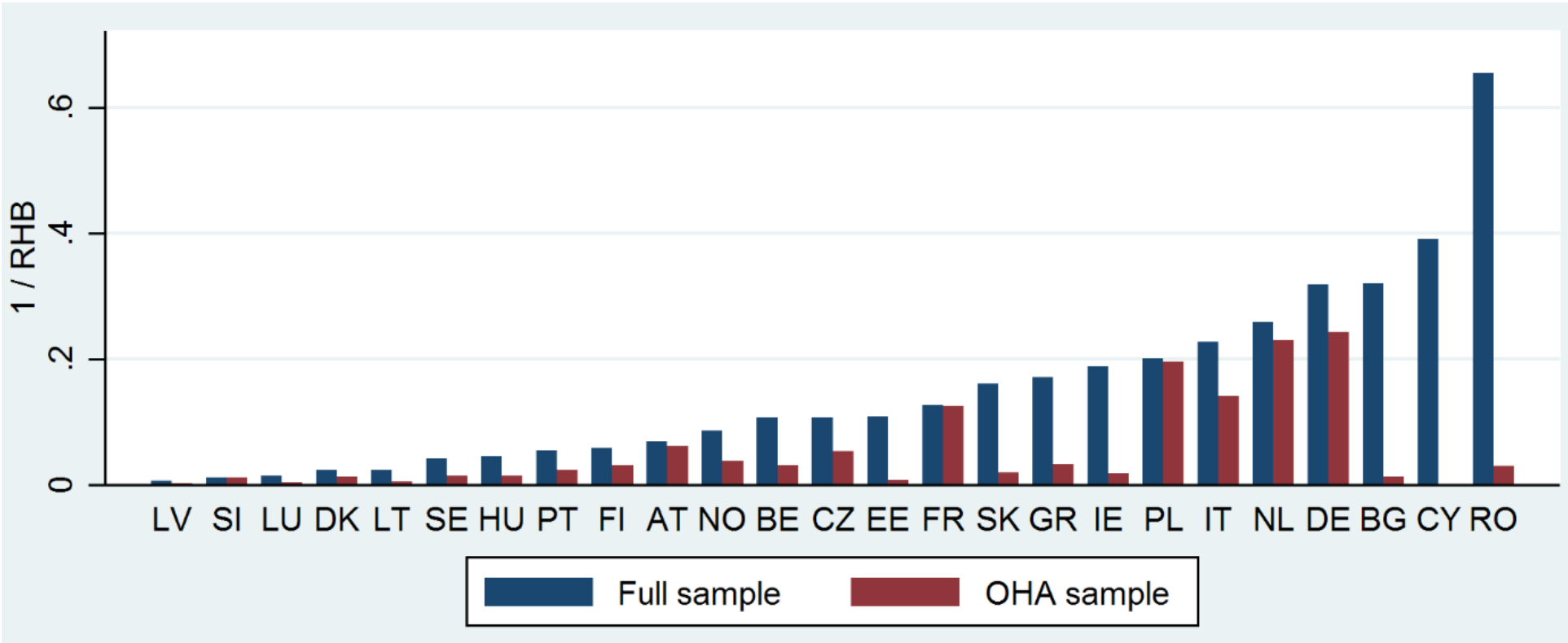
Buyer	Buyer			Seller
Country(***bc***)	Account holder(***bh***)	year	Purchase volume	Country(***sc***)
Germany	xxx1	2007	4300	Germany
Germany	xxx1	2007	350	France
Germany	xxx1	2007	100	Poland
Germany	xxx1	2007	0	United Kingdom
Germany	xxx1	2007	0	Spain
Germany	xxx1	2007	0	Portugal
Germany	xxx1	2007	0	Czech Republic
...	...	...	...	...

$\Rightarrow$Aggregate to buying account holder – selling country level, by year

$\Rightarrow$Result: Trade matrix with 1,629,730 rows

Inverse relative home bias

$$RHB_{bc} = \frac{\text{share of home purchases (bc)}}{\text{share of cap (bc)}}$$



Gravity equation

Model of bilateral trade as a function of

- countries' "mass" (usually GDP, here: country-year FE)
- home trade dummy

Log-linearized form:

$$ln(X_{bf,bc,sc,y}) = ln(\beta_0) + \beta_1 INTRA_{bc,sc} + \beta_2 \lambda_{bc,y} + \beta_3 \theta_{sc,y} + \beta_4 \gamma_{bf} + \epsilon_{bf,bc,sc,y}$$

Poisson Pseudo-maximum likelihood (PML) estimator developed by Santos Silva and Tenreyro (2006)

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Descriptive statistics

Table 1: Descriptive Statistics Key Variables

		Full Sample					
Variable	**Margin**	**Mean**	**Std. Dev.**	**Min.**	**Max.**	**Obs.**	**Units**
			Dependent Variable				
Purchases CO2 allowances	Overall	15,329	673,069	0	293,561,775	1,629,730	tCO2
	Intensive	812,517	4,833,840	1	293,561,775	30,746	tCO2
	Extensive	0.019	0.136	0	1	1,629,730	-
			Explanatory Variables				
INTRA	Overall	0.038	0.190	0	1	1,629,730	-
	Intensive	0.398	0.489	0	1	30,746	-
Log imports goods & services	Overall	7.775	2.351	0.090	14.834	1,629,730	millions of US dollars
	Intensive	10.884	2.703	1.094	14.834	30,746	millions of US dollars

Results: Home bias in allowance trade

Table 2: Home bias in allowance trade, 2005–2013

Dependent Variable:	Allowance purchases							
	Poisson PML				Probit	Poisson PML		Probit
	Overall (1)	Overall (2)	Overall (3)	Intensive (4)	Extensive (5)	Overall (6)	Intensive (7)	Extensive (8)
INTRA	2.911***	1.936***	1.832***	-0.017	0.139***	1.832***	0.782***	0.141***
	(0.314)	(0.197)	(0.193)	(0.091)	(0.017)	(0.193)	(0.094)	(0.013)
Buyer-country (BC) FE	no	yes	-	-	-	-	-	-
Seller-country (SC) FE	no	yes	-	-	-	-	-	-
BC-year FE	no	no	yes	yes	yes	yes	yes	yes
SC-year FE	no	no	yes	yes	yes	yes	yes	yes
Firm FE	no	no	no	no	no	yes	yes	yes
Obs.	1,629,730	1,629,730	1,629,730	30,746	1,629,730	1,604,295	30,746	1,629,730

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors (in parenthesis) are clustered on the buyer-seller country pair level. Overall: All allowance purchases within the full sample. Intensive: Observations with a positive transaction volume only. Extensive: Indicator function that is 1 in case of positive trade connections, and 0 otherwise. For Probit estimations, the average marginal effects are reported.

Results: Home bias in allowance trade

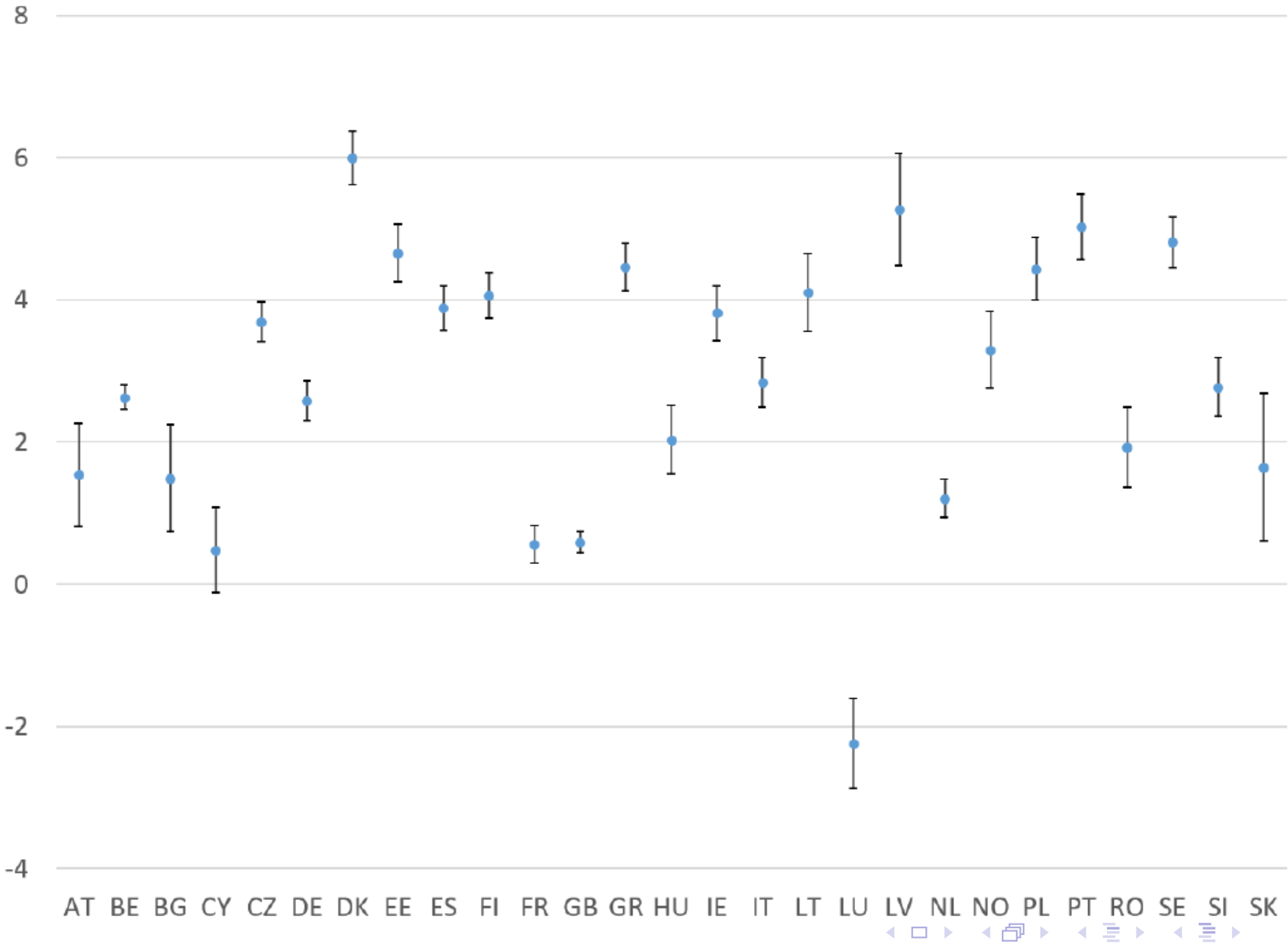
Preferred specification

Dependent Variable:	Poisson PML		Probit
	Overall (6)	Intensive (7)	Extensive (8)
INTRA	1.832***	0.782***	0.141***
	(0.193)	(0.094)	(0.013)
Buyer-country (BC) FE	-	-	-
Seller-country (SC) FE	-	-	-
BC-year FE	yes	yes	yes
SC-year FE	yes	yes	yes
Firm FE	yes	yes	yes
Obs.	1,604,295	30,746	1,629,730

Account holders trade $(e^{1.832}) * 100 = 6.26$ times more within than across country (increase of 526 %). Conditional on trading, they trade $(e^{0.782} - 1) * 100 = 119\%$ higher volumes domestically. They are 14.1 percentage points more likely to trade domestically than internationally.

Home bias by country

Figure 2: Country-specific home bias (dots) and 95% confidence intervals



Home bias by firm size (≈ purchase volume)

Table 3: Home bias by total purchase volume

Dependent Variable:	Allowance purchases		
	Poisson PML		Probit
	Overall	Intensive	Extensive
	(1)	(2)	(3)
INTRA	6.105***	-0.463	0.243***
	(0.995)	(1.109)	(0.030)
INTRA×Log total purchase volume	-0.238***	0.068	-0.0013***
	(0.059)	(0.063)	(0.0003)
BC-year FE	Yes	Yes	Yes
SC-year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Observations	1,629,730	30,746	1,629,730

Underlying mechanism

Only few exchanges exist

⇒ Off-exchange trade associated with information asymmetries

⇒ To decrease transactions costs, firms may use existing networks for trade in goods and services to trade allowances

Home bias despite product homogeneity and absence of transportation costs

⇒ No “nationality” of the product

⇒ Informational costs that increase when trading across borders

⇒ Sunk or variable?

⇒ Decrease in home bias over time?

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Controlling for trade in goods and services

Table 4: Home bias when controlling for trade in goods and services

Dependent Variable:	Allowance purchases		
	Poisson PML		Probit
	Overall	Intensive	Extensive
	(1)	(2)	(3)
INTRA	0.727*	0.760***	0.014**
	(0.442)	(0.241)	(0.006)
Log imports in goods & services	0.236**	0.005	0.0079***
	(0.094)	(0.051)	(0.0007)
BC-year FE	yes	yes	yes
SC-year FE	yes	yes	yes
Firm FE	yes	yes	yes
Obs.	1,629,730	30,746	1,629,730

$\Rightarrow$ Remaining home bias: Factor of 2.06 (instead of 6.26)

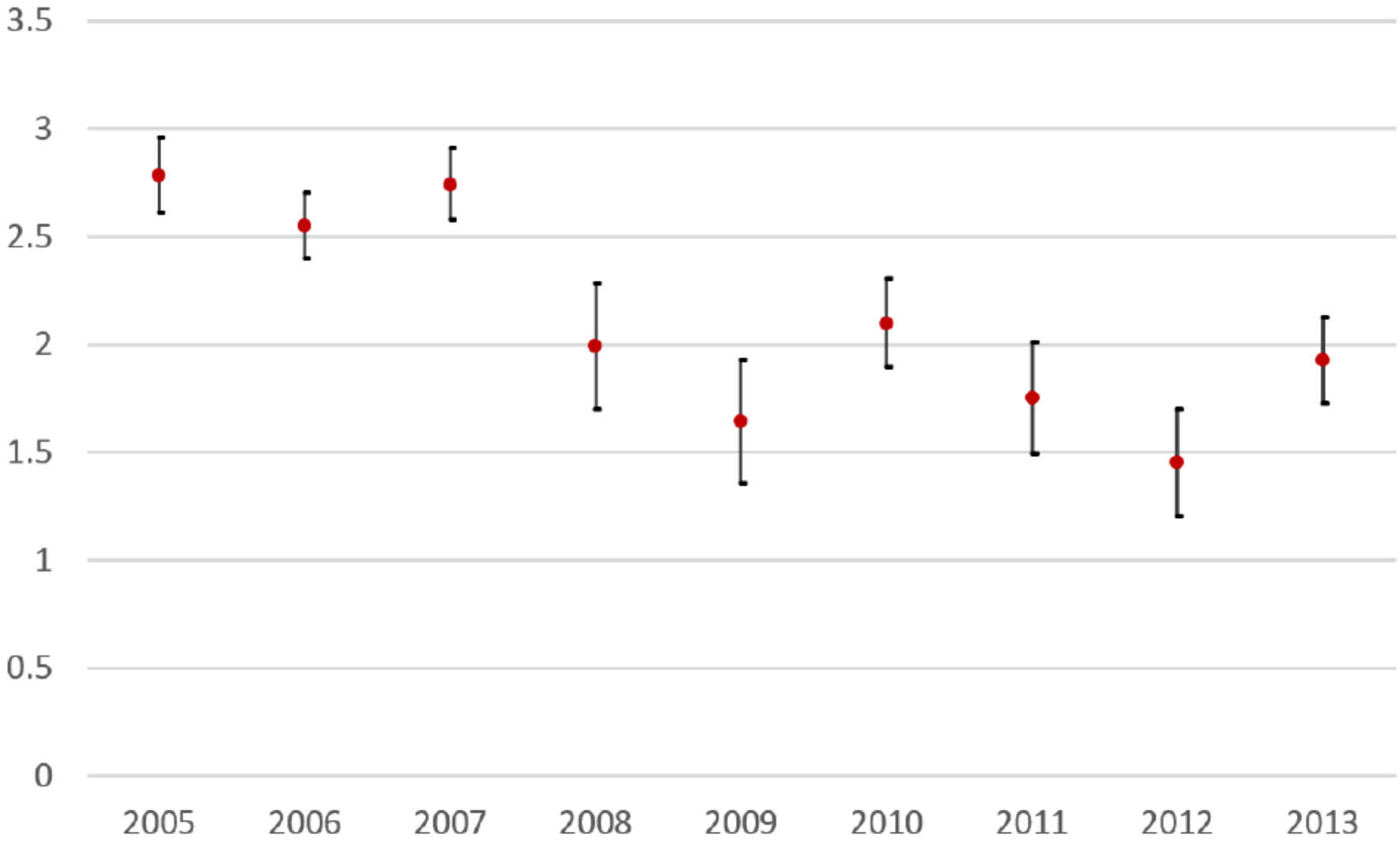
Sunk vs. variable costs

Table 5: Allowance purchases 2005-2013, conditional on established trade connections

Dependent Variable:	Allowance purchases		
	Poisson PML		Probit
	Overall	Intensive	Extensive
	(1)	(2)	(3)
INTRA	2.444***	0.659***	0.115***
	(0.241)	(0.239)	(0.009)
EST	2.527***	0.520***	0.092***
	(0.132)	(0.097)	(0.005)
INTRA*EST	-1.419***	0.078	-0.014***
	(0.259)	(0.251)	(0.001)
BC-year FE	Yes	Yes	Yes
SC-year FE	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes
Observations	1,629,730	30,746	1,629,730

Home bias over time

Figure 3: Home bias (dots) over time and 95% confidence intervals.



Robustness tests

- Remove trade of firms belonging to same GUO
- Trade between OHAs only
- VAT fraud (remove FR, first phase only)
- Selling rather than buying

Conclusions

- Home bias in allowance trade
  - Heterogeneity with respect to location (country) and size (trade volume)
  - Decreasing but persistent
- Price plus transactions costs not equalized across firms
- Informational frictions likely larger in non-unified markets than within EU
- Welfare implications not clear: Home bias for homogenous good is necessary but not sufficient condition for welfare loss
  - Magnitude of price wedge matters
  - Problem: Prices in OTC and bilateral trades not observable
  - But: Large fees at EEX, and many firms did not trade at all