Measuring quality and selling capacity at a country-product level

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Some background information

This paper builds on a recently published paper:

Di Comite, Thisse, Vandenbussche,"Verti-zontal differentiation in export markets" (JIE, 2014)

Raising two additional research questions

- ***Do V-Z results hold at an aggregate level?***
- ***How to use the model to develop indicators of competitiveness?***

Presentation outline

- ***Motivation;***
- ***Brief description of the verti-zontal model***
- ***Test of the model using aggregate trade data;***
- ***Parameter Identification strategy;***
- ***Preliminary results and outstanding issues.***

Motivation

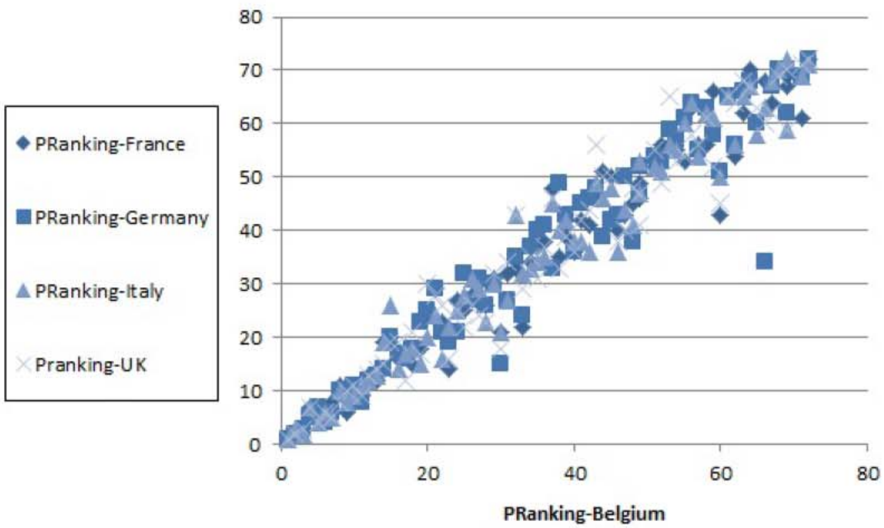
Motivation

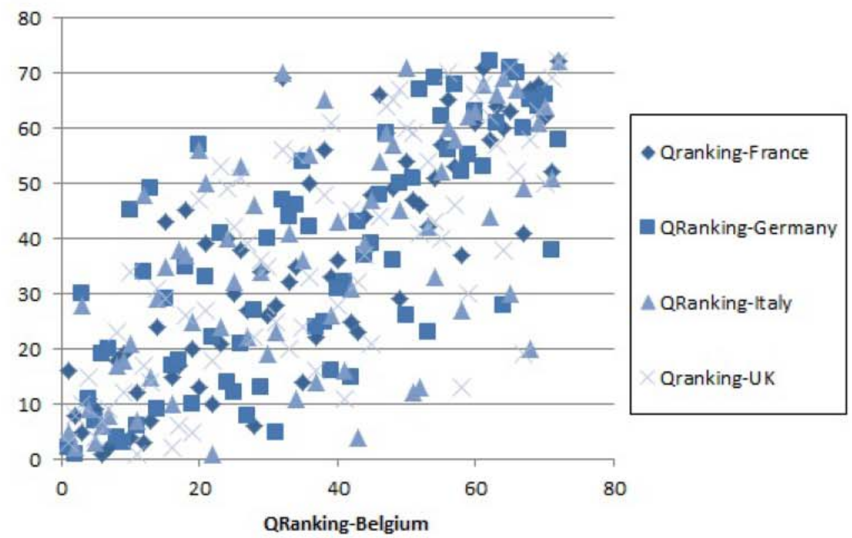
- Currently, several competing trade theories co-exist:
  - **CES models** with **cost** heterogeneity (Melitz,2003), **taste** draws (Bernard & al., 2011; Benkovskis & Wörz, 2014) or **quality** augmentation (Baldwin & Harrigan,2011);
  - **Discrete-choice**-based models (Anderson & al.,1992; Fajgelbaum et al., 2011);
  - **Quadratic utility models** based on Melitz & Ottaviano (2008).
- Building on these theories, indicators of competitiveness or quality of exports have been recently developed:
  - Khandelwal (2010); Hallak &Schott (2011); Feenstra & Romalis (2012).
  - In these models, **quality is approximated by demand shocks**.
- But these models cannot account for the combination of two key empirical features characterizing trade patterns:
  - **<u>Markups vary across markets</u>** (more than transport costs can explain);
  - **<u>Quantity variation is systematically higher than price variation</u>** (so they cannot depend on the same set of parameters).

Thought experiment

- Think about one variety of a product sold in different market: how should price and quantity rankings correlate across the markets served?

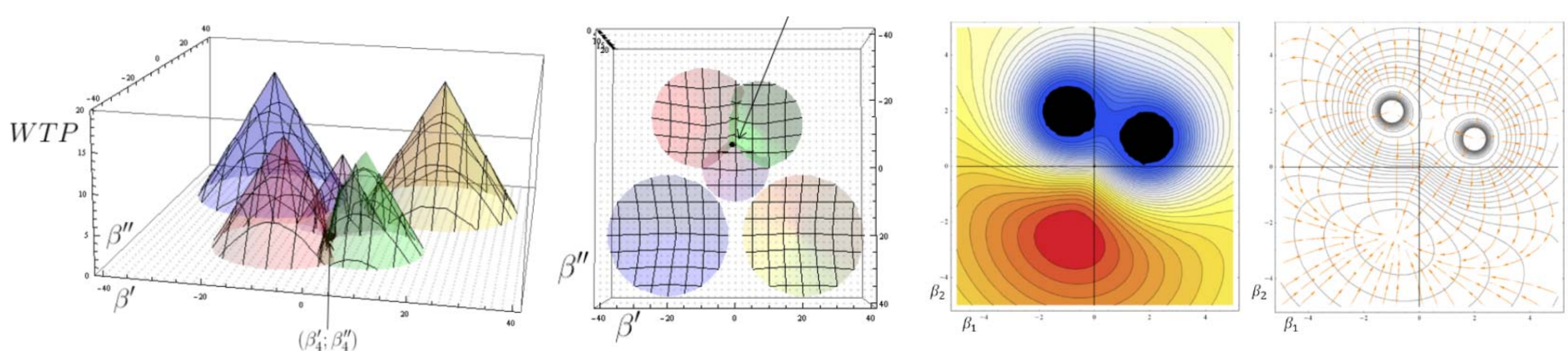
    In CES with linear transport costs or discrete choice models the same level of variability is expected, but in reality:





Motivation

- In the Chamberlinian tradition, mon. comp. trade theories exhibit:
  - **Varieties entering symmetrically** consumer preferences;
  - **Prices and quantities** being determined by the **same set of parameters**;
  - **Simplified competitive interactions** between varieties (only prices matter).
- The verti-zontal model addresses these issues generalizing **a Hotelling-like spatial problem into a trade model**:
  - **Varieties have an "address"** in the characteristics space;
  - They enter **asymmetrically** the preferences of **heterogeneous consumers**.



Theoretical underpinnings

Functional form

Linear demand/Quadratic Utility:

- "Verti-zontal" variation of Melitz-Ottaviano (2008)

$$U_i = \alpha \int_{s \in S_i} q_i(s) ds - \frac{\beta}{2} \int_{s \in S_i} q_i^2(s) ds - \frac{\gamma}{2} \left[\int_{s \in S_i} q_i(s) ds \right]^2 + q_0$$

$$U_i = \int_{s \in S_i} \alpha(s) q_i(s) ds - \int_{s \in S_i} \frac{\beta_i(s)}{2} q_i^2(s) ds - \frac{\gamma}{2} \left[\int_{s \in S_i} q_i(s) ds \right]^2 + q_0$$

- With firms incurring fixed and variable production costs

Functional form

Consider only 1 market (to get rid of subscript *i*):

$$U = \int_S \alpha_s q_s ds - \frac{1}{2}\int_S \beta_s q_s^2 ds - \frac{\gamma}{2}\left(\int_S q_s ds\right)^2 + q_0$$

This can be seen as the *aggregation in S* of: $u_s = \alpha_s q_s - \frac{\beta_s}{2} q_s^2 - \frac{\gamma}{2} q_s \left[\int_S q_r dr\right] + q_0$

which is the multi-variety equivalent of: $u_s = \alpha_s q_s - \frac{\beta_s}{2} q_s^2 + q_0$

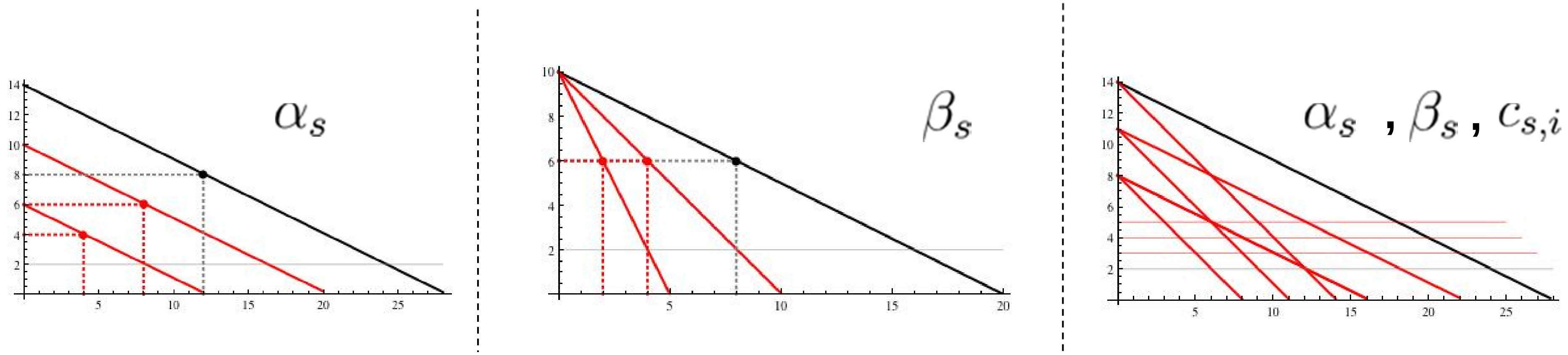
Role of parameters

On top of standard source of heterogeneity, ⇨ $c_{s,i}$

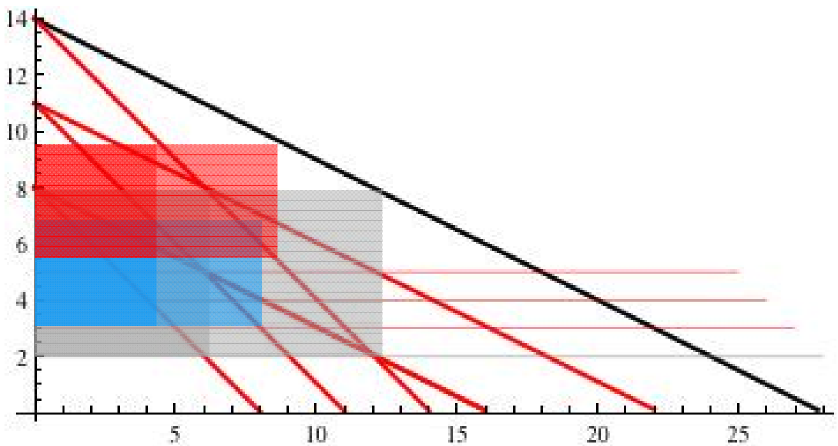
vertical differentiation ⇨ α_s

and horizontal differentiation ⇨ $\beta_{s,i}$

Holding substitutability between varieties fixed, γ



Market outcomes



$$p^*_{s,i} = \frac{\alpha_s + c_s}{2} - \mathcal{T}_i\left(\frac{\tilde{a}_i - \tilde{c}_i}{2}\right)$$

$$q^*_{s,i} = \frac{1}{\beta_{s,i}}(p^*_{s,i} - c_s)$$

$$\mathbb{P} = \int_S \frac{p^*_s}{\beta_s} ds \qquad \mathbb{N} = \int_S \frac{ds}{\beta_s}$$

$$\tilde{\alpha}_i = \frac{1}{\mathbb{N}_i} \int_{s \in S_i} \frac{\alpha_s ds}{\beta_{s,i}}$$

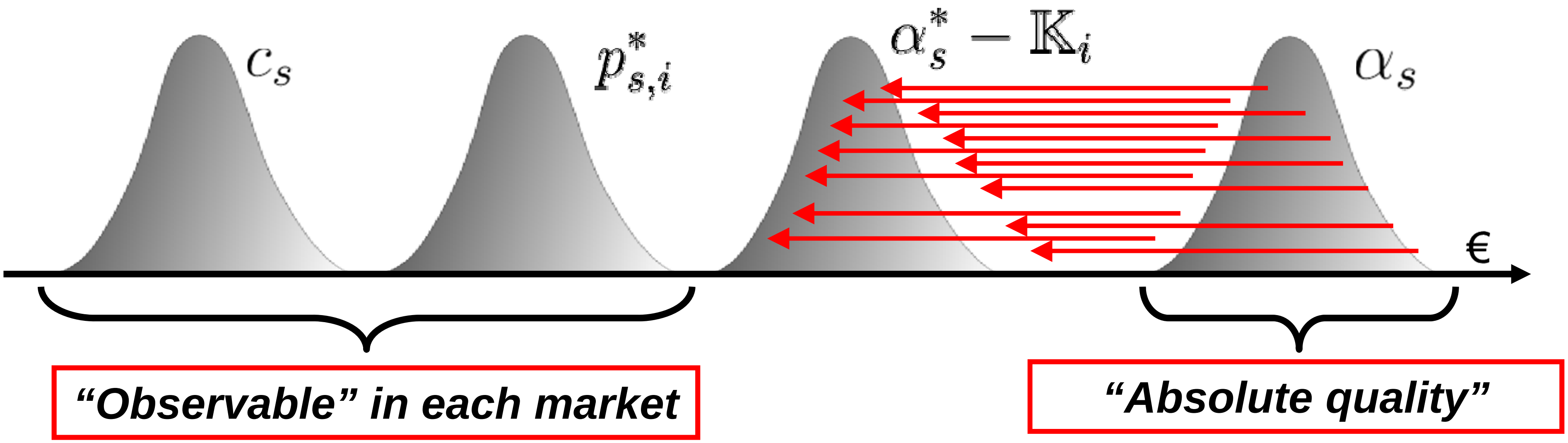
$$\tilde{c}_i = \frac{1}{\mathbb{N}_i} \int_{s \in S_i} \frac{c_{s,i} ds}{\beta_{s,i}}$$

$$\tilde{p} = \mathbb{P}/\mathbb{N} = \tilde{\alpha}\frac{1}{2+\gamma\mathbb{N}} + \tilde{c}\frac{1+\gamma\mathbb{N}}{2+\gamma\mathbb{N}}$$

Sources of variability

$$p^*_{s,i} = \frac{\alpha_s + c_s}{2} - \mathcal{T}_i\left(\frac{\tilde{a}_i - \tilde{c}_i}{2}\right) \; ; \quad q^*_{s,i} = \frac{1}{\beta_{s,i}}(p^*_{s,i} - c_s)$$

Variety *s* **Market *i*** **Market-variety *(s,i)***



Possible experiments

Note that $$p^*_{s,i} = \underbrace{\frac{\alpha_s + c_s}{2}} - \underbrace{\mathcal{T}_i\left(\frac{\tilde{a}_i - \tilde{c}_i}{2}\right)}$$

VARIETY EFFECT
(Notice: no β)

MARKET EFFECT
(β of the other varieties, implicitly in indices)

- **Holding market fixed, <u>Varieties</u> can be compared;**
- **Holding variety fixed, <u>Markets</u> can be compared.**

Testing the model with aggregate data

Data, products, varieties

- In the previous paper, the V-Z model has been tested on the universe of Belgian exporters (variety as firm-CN8);

- In the aggregate macro context, Eurostat COMEXT:
  - ***First defining product as CN6 and varieties as CN8*** (from BE):
    - Advantage: fixing the origin, transport costs to the same destination for the same CN6 may be considered equal;
    - Disadvantage, CN8 varieties describe different products in reality.
  - ***Then products as CN8 and varieties as country-CN8:***
    - Advantage: products are homogeneous across varieties (the only difference being the place where they are produced);
    - Disadvantage: different transport costs may alter the results.

Data, products, varieties

From the micro-level dataset…

	WEIGHT		UNITS	
	(1) Full sample	(2) Restricted sample	(3) Full sample	(4) Restricted sample
Observations	239,127	111,876	52,227	20,929
Firms	5,386	3,528	2,521	1,067
CN2 Products	95	89	56	46
CN4 Products	1,159	755	315	182
CN6 Products	4,122	1,999	1,161	494
CN8 Products	7,051	2,691	1,922	604
Firm-CN2 Combinations	20,358	8,835	4,844	1,748
Firm-CN4 Combinations	36,709	13,333	7,000	2,320
Firm-CN6 Combinations	50,234	17,759	10,243	3,454
Firm-CN8 Combinations	62,355	19,612	12,842	3,703
Destinations	220	139	206	108
CN2-Destination Combinations	8,283	3,646	3,236	1,214
CN4-Destination Combinations	38,924	13,089	9,404	2,544
CN6-Destination Combinations	78,997	23,738	19,500	4,908
CN8-Destination Combinations	107,681	28,343	26,538	5,548

	Belgian CN8 exports	
	(1) Full sample	(2) Restricted
Observations	177,230	60,401
Exporters	1	1
CN2 Products	96	89
CN4 Products	1,221	668
CN6 Products	4,932	1,471
CN8 Products	8,958	4,619
Destinations	185	167
Importer-CN2 Combinations	10,013	4,590
Importer-CN4 Combinations	57,231	14,667
Importer-CN6 Combinations	132,589	22,914
Importer-CN8 Combinations	177,230	60,401
Trade volume (bill. euros)	249	67.5

… to the aggregate CN8 product exports.

Individual dummies

Belgian exports

	(1) $y = p, q$	(2) $y = p, q$	(3) $y = p, q$	(4) $y = p, q$	(5) $y = p, q$	(6) $y = p, q$	(7) $y = p, q$
CN2 Product FE	YES						
CN4 Product FE		YES					
CN6 Product FE			YES				
CN8 Product FE				YES			
Importer-CN2 FE					YES		
Importer-CN4 FE						YES	
Importer-CN6 FE							YES
Goodness of fit							
Price reg. R^2	22.6%	39.2%	47.8%	60.8%	29.2%	56.6%	68.6%
Quantity reg. R^2	2.8%	7.2%	10.5%	20.4%	16.7%	37.1%	52.1%
Q.per Capita reg. R^2	3.9%	8.7%	12.1%	21.6%	18.6%	38.9%	52.0%
Q.per GDP reg. R^2	6.0%	13.7%	17.9%	27.7%	30.1%	47.8%	56.4%
F-tests							
Price reg. F	203.60	58.26	36.87	18.86	5.08	4.11	3.58
Quantity reg. F	20.07	7.00	4.73	3.12	2.47	1.86	1.79
Q.per Capita reg. F	28.48	8.64	5.53	3.35	2.82	2.00	1.78
Q.per GDP reg. F	44.46	14.42	8.79	4.68	5.30	2.88	2.12

Analysis of Variance

ANOVA in regressions with two sets of dummies:

Very similar levels of variability explained, per regressor

Mean Sum of Squares in price regressions ($y = p$)			
	(1)	(2)	(3)
Variety FE	3.35E+07	3.03E+07	3.04E+07
Country CN2 FE	6.53E+06		
Country CN4 FE		8.48E+06	
Country CN6 FE			8.35E+06
Mean Sum of Squares in quantity regressions ($y = q$)			
	(1)	(2)	(3)
Variety FE	3.57E+09	2.49E+09	2.50E+09
Country CN2 FE	2.47E+09		
Country CN4 FE		2.82E+09	
Country CN6 FE			2.66E+09

Dummy Regressions

Regressions results with two sets of dummies:

	(1) $y = p, q$	(2) $y = p, q$	(3) $y = p, q$	(4) $y = p, q$
CN2 Product FE	YES			
CN4 Product FE		YES		
CN6 Product FE			YES	
CN8 Product FE				YES
Importer-CN2 FE	YES			
Importer-CN4 FE		YES		
Importer-CN6 FE			YES	
Importer-CN8 FE				YES
Goodness of fit				
Price regression R^2	61.1%	65.0%	74.6%	80.0%
Quantity regression R^2	26.9%	36.9%	53.6%	63.5%
Q per capita regression R^2	31.1%	40.7%	55.3%	64.2%
Q per GDP regression R^2	28.2%	40.2%	50.5%	56.4%
Number of dummies	4,825	9,263	19,466	27,905

Dummy Regressions

Regressions results with two sets of dummies, product by product:

Quantities are systematically more volatile than prices!

(even if, again, with micro data this was more evident)

	(1) Weighted averages	(2) R^2 for R^2 Price > Quantity	(3) Simple averages	(4) Number of products
by CN2				89
Price R^2	**51.1%**	.	**58.8%**	
Quantity R^2	30.0%	78.7%	43.0%	
Q per capita R^2	35.5%	76.4%	47.0%	
Q per unit of GDP R^2	33.8%	86.5%	37.8%	
by CN4				671
Price R^2	**55.0%**	.	**63.0%**	
Quantity R^2	43.7%	63.6%	56.4%	
Q per capita R^2	47.5%	60.8%	59.3%	
Q per unit of GDP R^2	37.7%	87.0%	40.5%	
by CN6				1482
Price R^2	**78.8%**	.	**64.7%**	
Quantity R^2	73.4%	56.0%	62.3%	
Q per capita R^2	77.0%	52.1%	64.6%	
Q per unit of GDP R^2	55.9%	87.6%	40.6%	

Dummy Regressions

Regressions results with two sets of dummies within different industry categories:

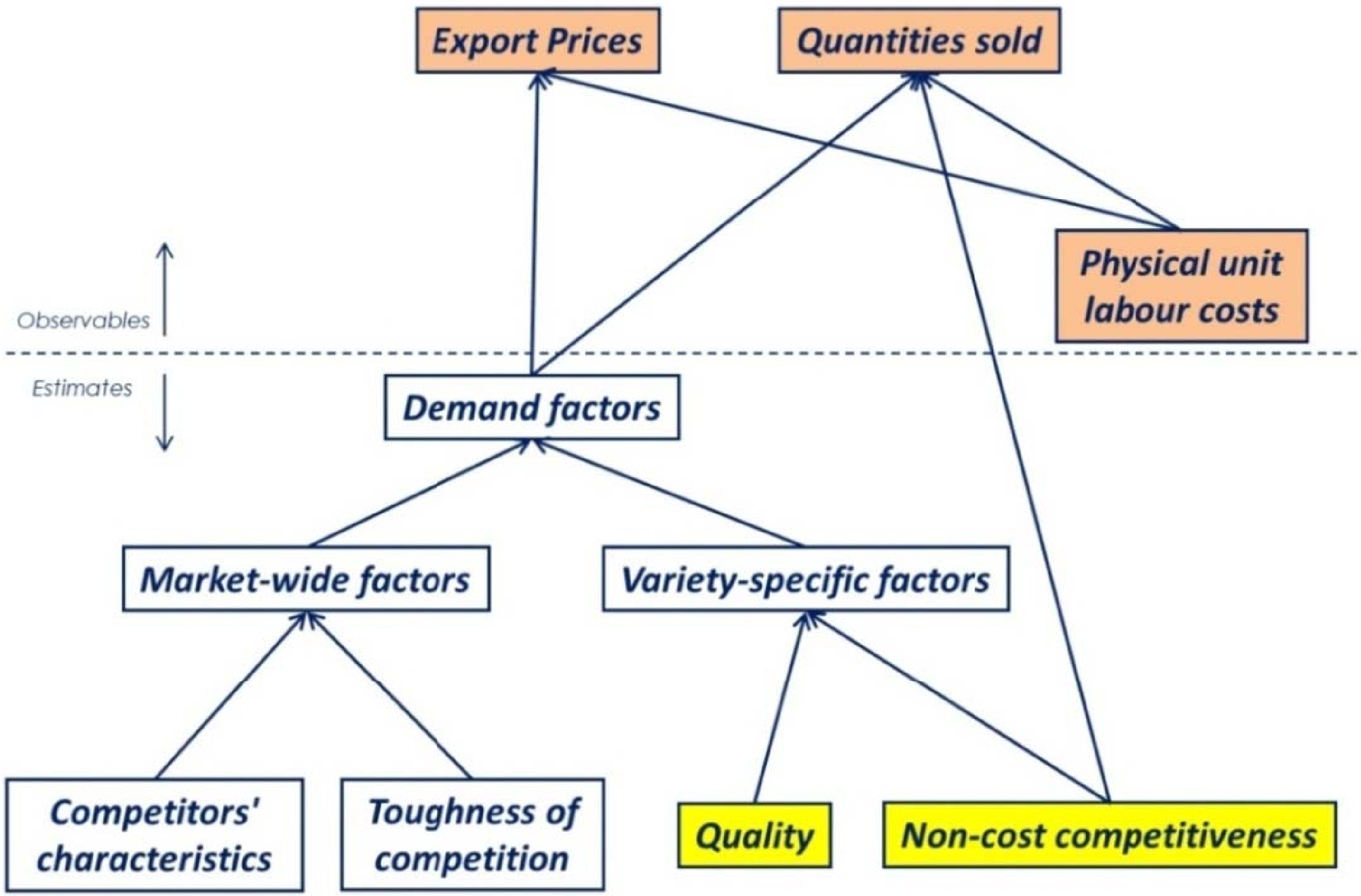
INDUSTRIES (*corresponding CN2 product codes*)	(1) R^2 of price regression	(2) R^2 of quantity regression	(3) Number # of Observations	(4) Model degrees of freedom
Agriculture *CN2 codes 1 to 15*	45.16%	36.83%	6,343	998
Food, beverages *CN2 codes 16 to 24*	22.36%	27.95%	6,578	700
Minerals, chemicals *CN2 codes 25 to 38*	56.08%	31.95%	9,039	752
Plastics and rubber *CN2 codes 39 and 40*	36.26%	33.23%	4,989	338
Leather, skins, wood *CN2 codes 41 to 46*	65.25%	35.68%	1,929	260
Articles of paper *CN2 codes 47 to 49*	42.17%	34.22%	1,871	223
Textile articles *CN2 codes 50 to 63*	47.84%	30.19%	5,849	625
Footwear, accessories *CN2 codes 64 to 67*	53.97%	41.73%	422	116
Construction materials *CN2 codes 68 to 70*	40.98%	30.08%	2,255	263
Base metals, jewelry *CN2 codes 71 to 83*	63.11%	31.85%	8,371	698
Mechanical appliances *CN2 codes 84 and 85*	47.72%	22.55%	18,234	1,179
Transport equipment *CN2 codes 86 to 89*	53.02%	25.71%	3,211	311
Precision instruments *CN2 codes 90 to 93*	48.88%	18.79%	2,593	305
Furniture and toys *CN2 codes 94 to 96*	47.01%	26.26%	3,055	278

Alternative theories: why not?

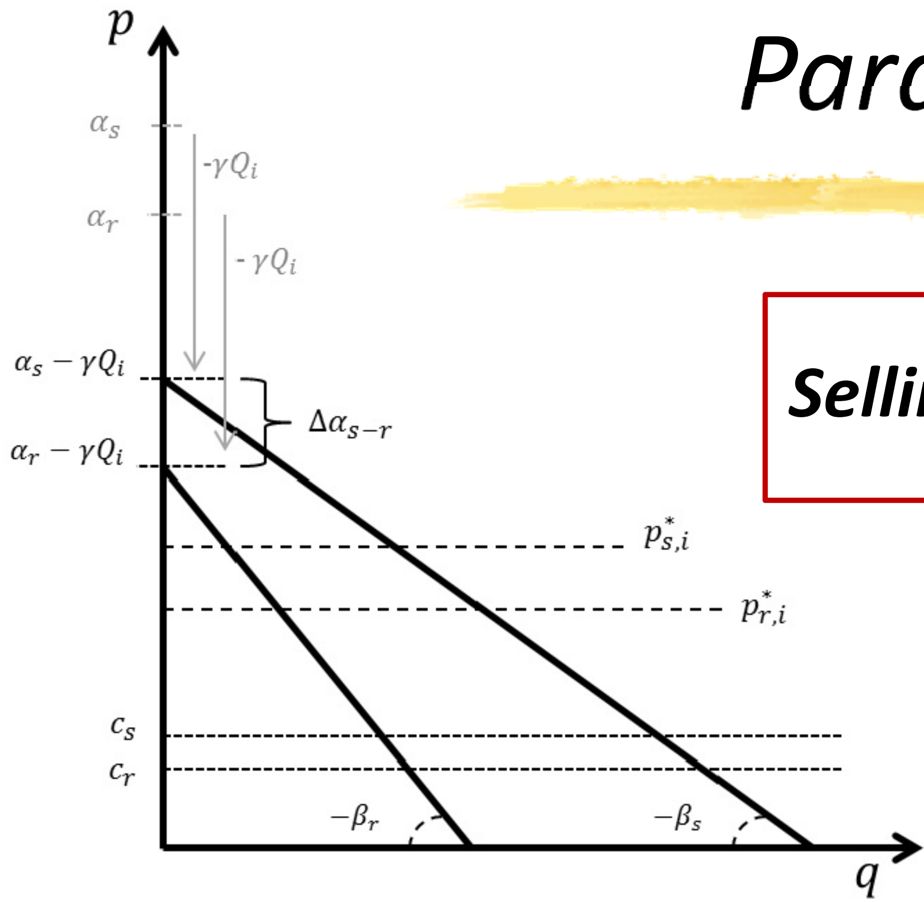
- CES models with cost heterogeneity or variety-specific quality:
  - Would not display price variability across countries.
- CES models with local taste draws (as demand shocks) and discrete-choice theories:
  - Would have prices and quantities co-moving across markets (with positive correlation).
- Similarly, the standard quadratic utility:
  - Would have prices and quantities co-moving across markets (with negative correlation).

Identification strategy

Data needs for identification



Parameters' relations



Selling capacity: $1/\beta_{s,i} = \dfrac{q_{s,i}}{p_{s,i} - c_s}$

Relative quality:

$$\Delta\alpha_{s-r} = 2\Delta p^*_{s-r,i} - \Delta c_{s-r}$$

To identify the substitutability parameter, γ, take the inverse demand intercept (IDI) of the lowest-relative-quality variety $IDI_{0,i} = 2p_{0,i} - c_0$ and notice that $IDI_{0,i} = \alpha_0 - \gamma Q_i$

⇨ Regressing IDI on Q, gives α_0 as the constant and γ as the coefficient of Q

Data availability in the EU

- **Eurostat COMEXT (at a CN8 product level):**
  - Exports (in values/volumes);
  - Total intra-EU28 imports;
  - Total extra-EU imports.

Do monopolistic competition assumptions hold?

- **AMECO:**
  - Total consumption;
  - Compensation of employees by branch of activity;
  - Gross Value Added by branch of activity;
  - Consumption’s price deflator.

Intermediate identification steps

- **Intermediate indicators:**
  - Export prices (values/quantities);
  - Branch-level Unit Labor Costs (Value Added/wages);
  - Physical Unit Labor Costs (ULC*exports/volumes);
  - Varieties' import and export market shares;
  - Consumption levels of each product (derived from import and export shares of each product);
  - Deflated export prices (export prices*deflator).

Identification outcomes

- The **final outcomes** of the identification strategy are, in order:
  - A selling capacity parameter; $\beta_{s,i,t}$
  - A degree-of-substitutability parameter; γ
  - A quality parameter for the worst-quality variety; α_0
  - A quality parameter for all the varieties. α_s

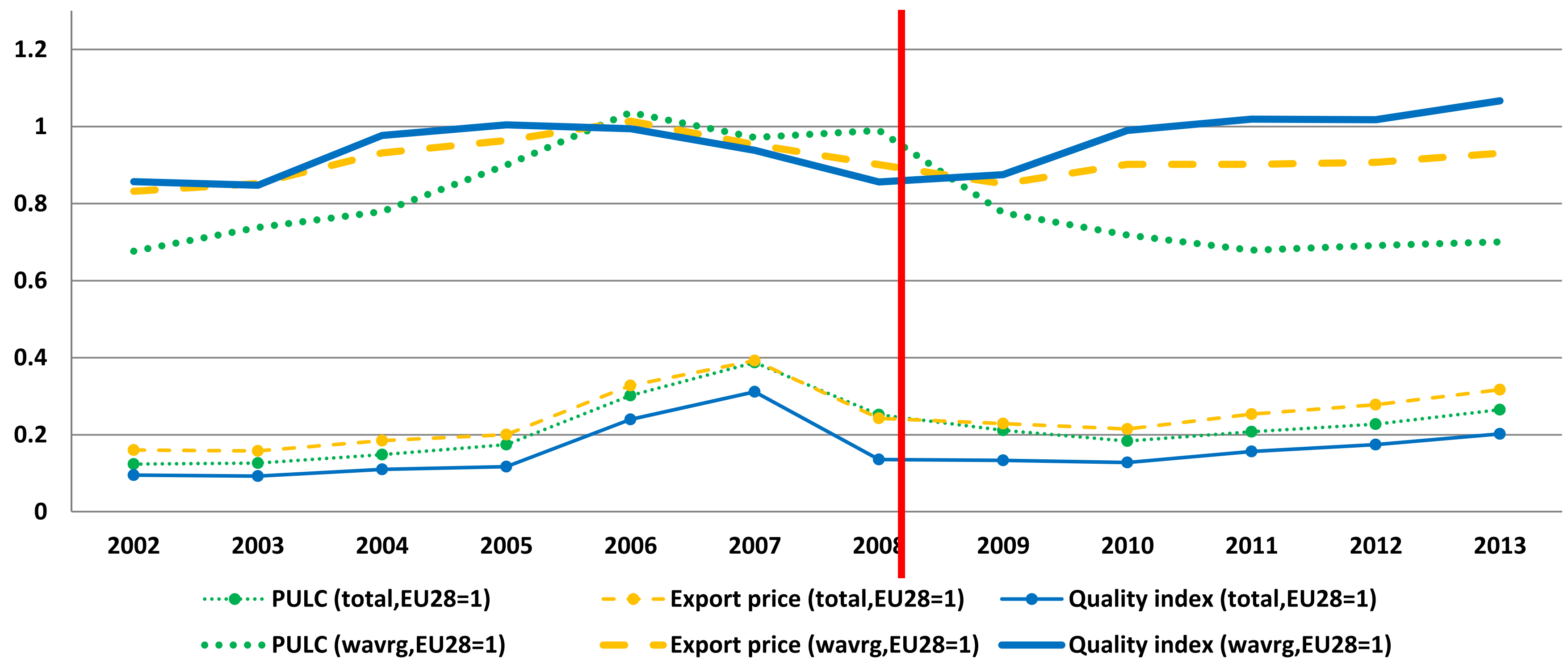
- These can be **represented** in different ways:
  - In absolute/relative terms wrt to a reference point;
  - In cross sectional or longitudinal terms;
  - In «weighted average» or «total export» terms.

Illustration of results for some member states

The Latvian example - graphs

Evolution of Latvian PULC, quality and export prices as compared to the EU28 (=100)

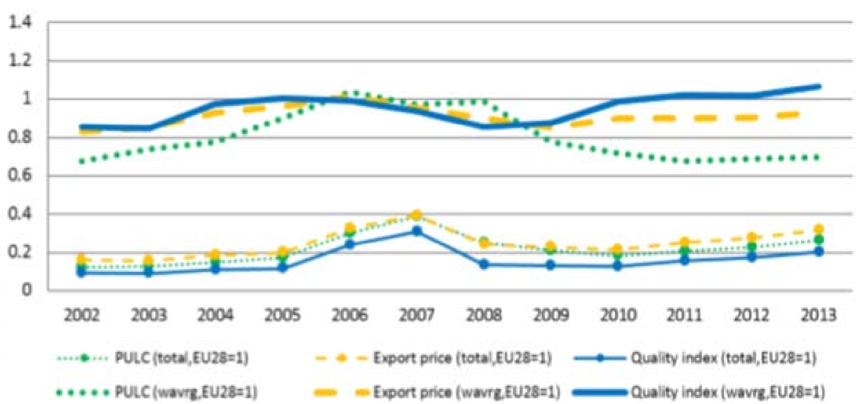
Adjustment following the financial crisis



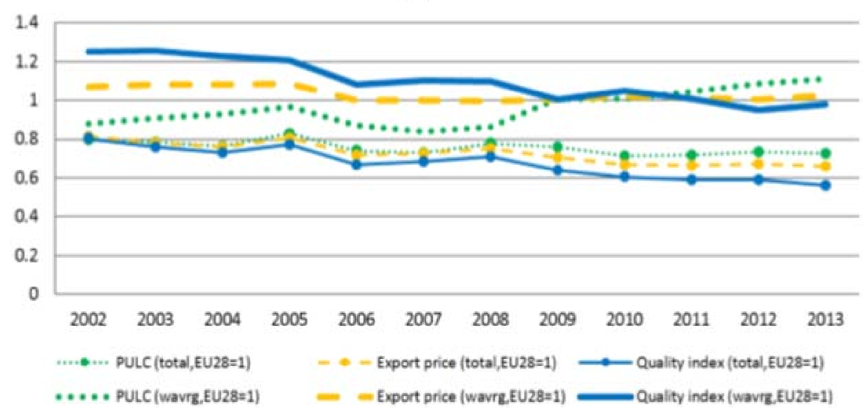
Latvia and Finland

Evolution of Latvian and Finnish PULC, quality and export prices as compared to the EU28 (=100)

(a) Latvia

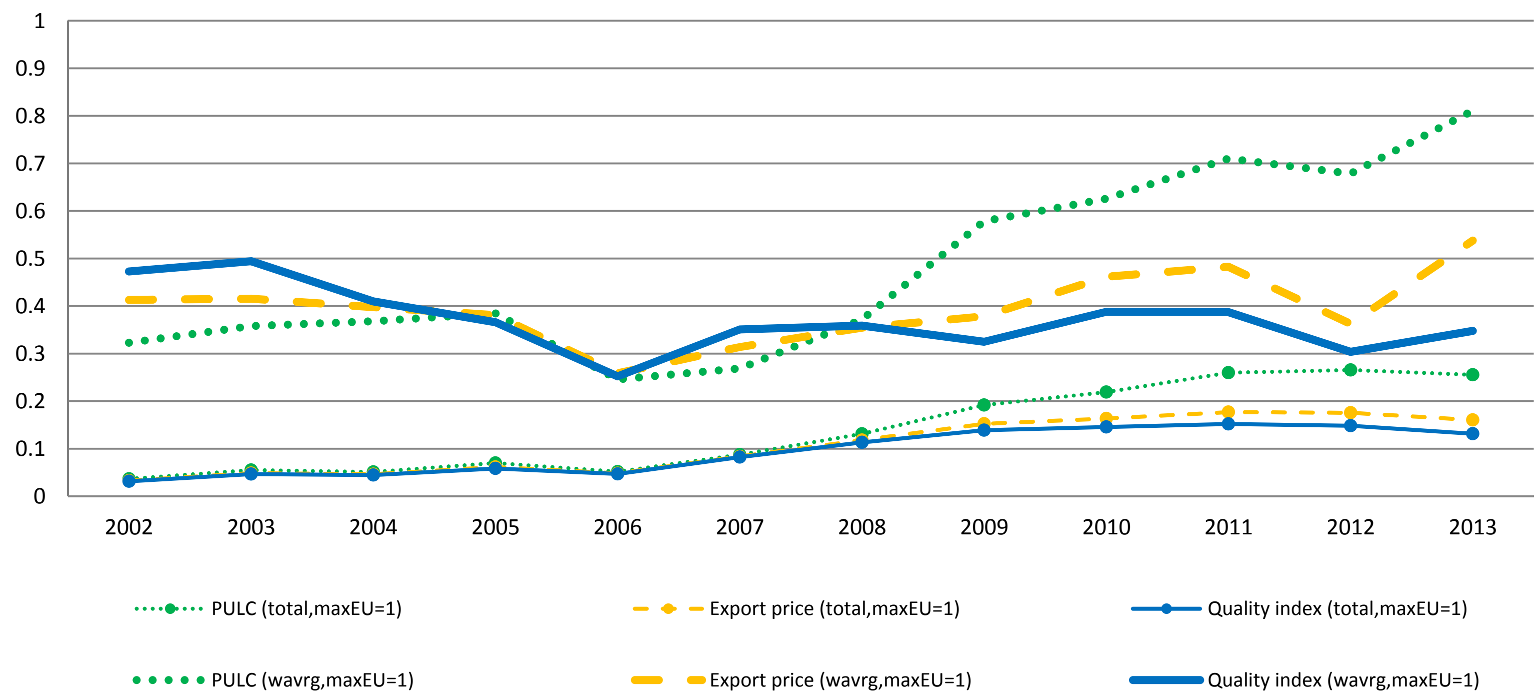


(b) Finland



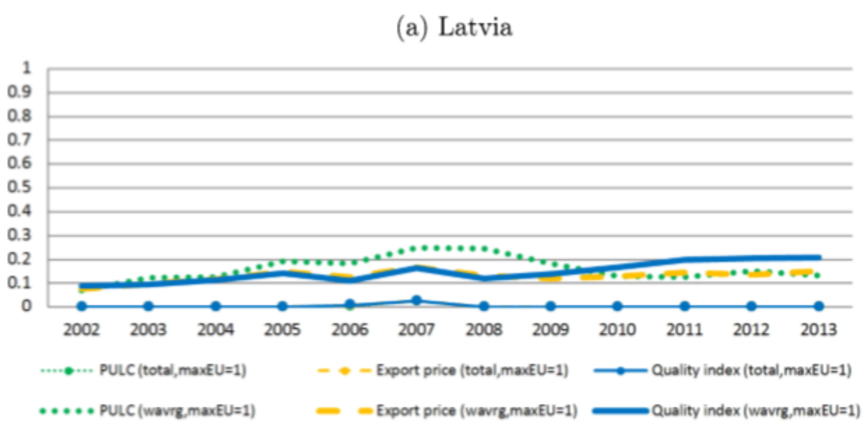
The Finnish example - graphs

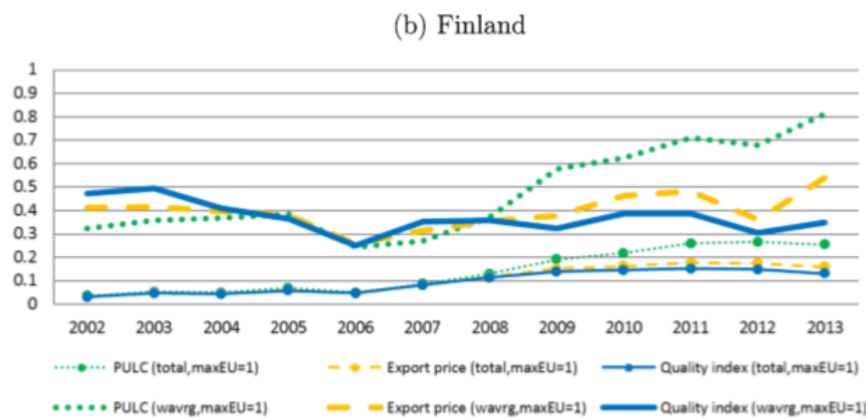
Evolution of Finnish PULC, quality and export prices as compared to the minimum/maximum in the EU28 (0 to 1)



Latvia and Finland

Evolution of Latvian and Finnish PULC, quality and export prices as compared to min/max in the EU28 (0 to 1)

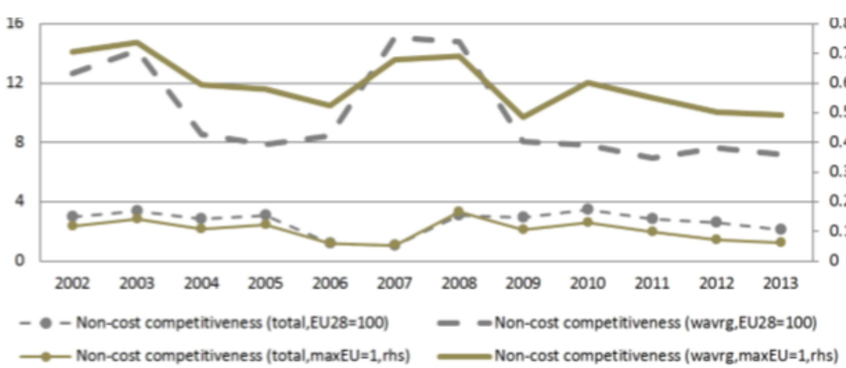




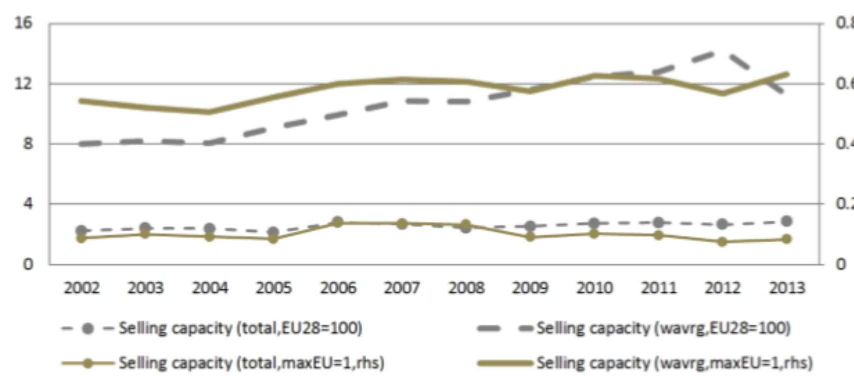
Latvia and Finland

In terms of selling capacity, though, Finland shows a better evolution than Latvia in total exports and a similar performance in weighted average terms:

(a) Latvia

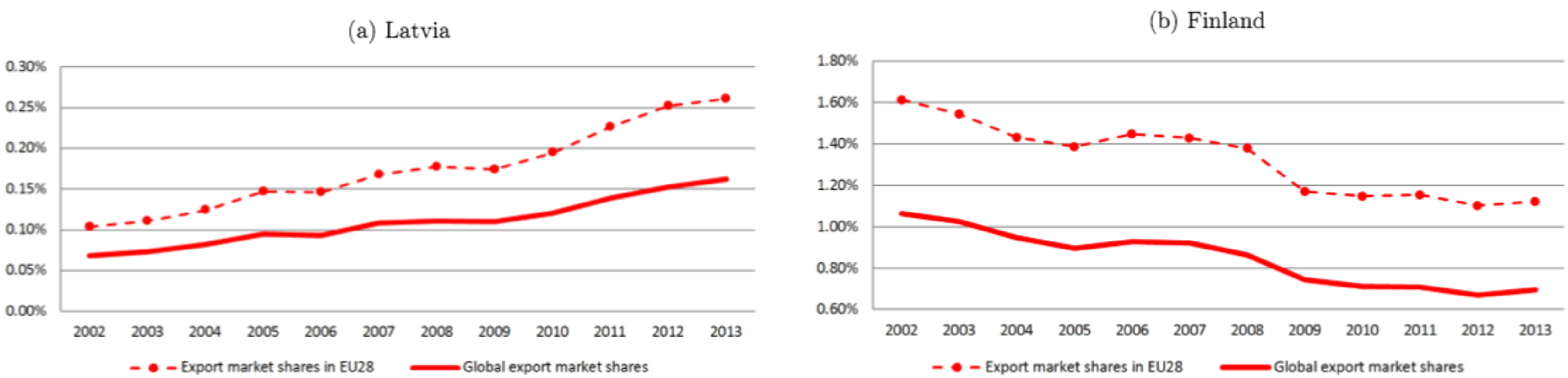


(b) Finland



Latvia and Finland

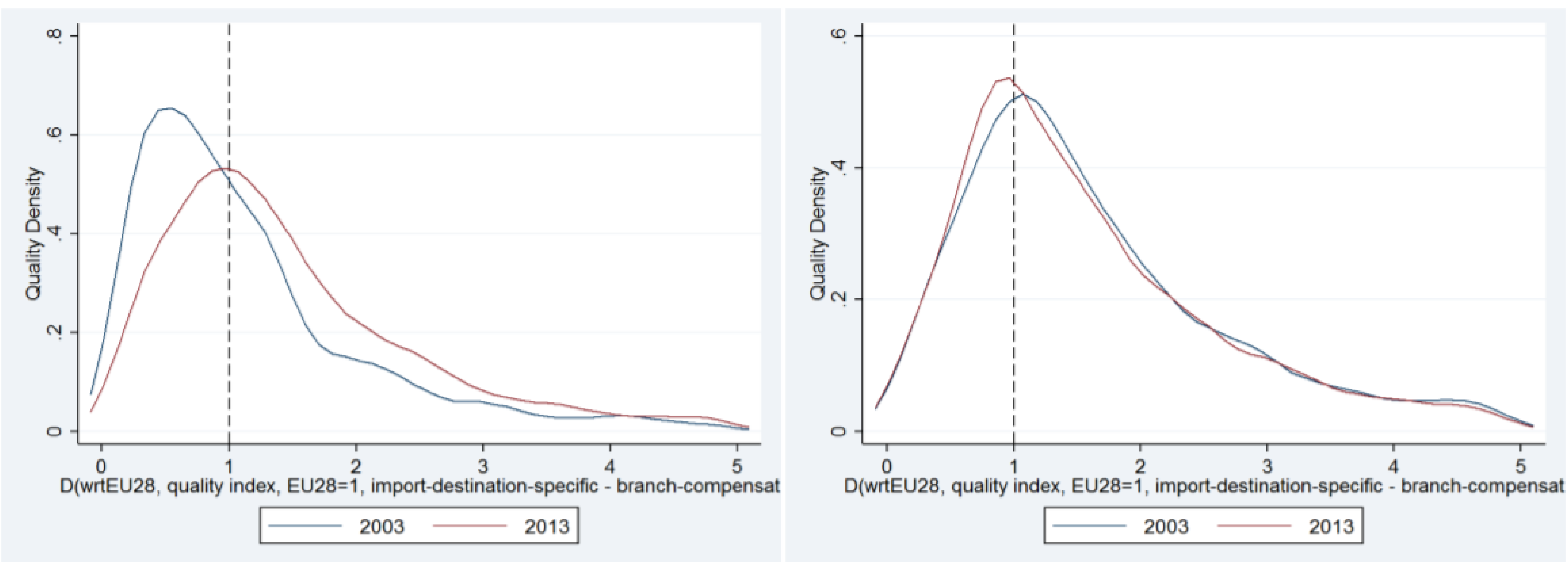
<u>However, the loss of competitiveness in labour cost terms more than offsets the increase in Finnish selling capacity, explaining the decrease in Finnish market shares (in EU and globally), as opposed to Latvian growth.</u>



Latvia and Finland

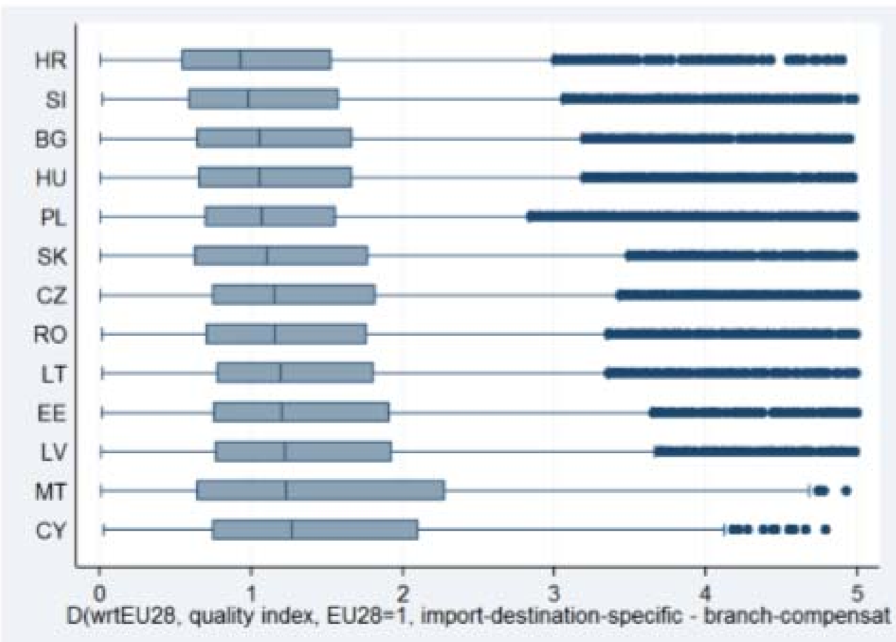
<u>Also the evolution of CN8 quality distributions in Latvia and Finland show an impressive quality upgrading of the former and the difficulties of the latter.</u>

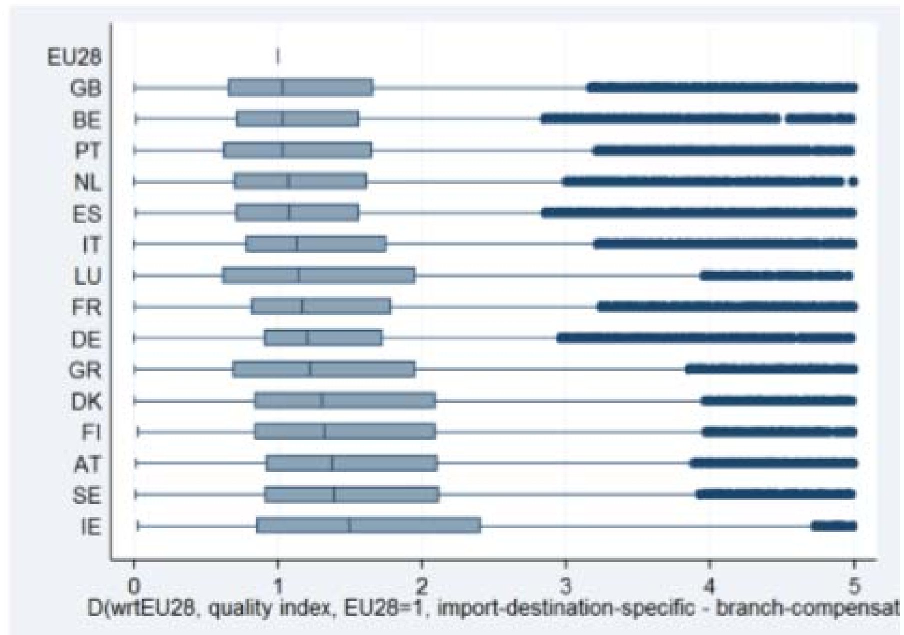
(a) Latvia (b) Finland



EU member states distributions

Finally, quality distributions can be plotted for all the EU28 member states, yielding reasonable rankings:





Possible next steps

- Higher frequency of trade statistics (monthly);
- Better estimates of marginal costs of production;
- Improved product-level consumption estimates;
- Clear distinction between differentiated goods and relatively inelastic “commodities”;
- Model parameters are “measured”, but not “explained” yet: that will require an explicit strategy.

Conclusion

- The verti-zontal model seems to be apt to be exploited in an aggregate macro context;
- It can be used to extract useful macro information on country-product characteristics;
- However, there are still issues to be solved for the theoretical model to be confronted with real trade data.

Feedbacks are most welcome!

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Data, products, varieties

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	EU28 cross-section		Belgian CN8 exports	
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Observations	2,713,816	2,086,945	177,230	60,401
Exporters	28	28	8958	4619
CN2 Products	96	96	96	89
CN4 Products	1244	1218	1221	668
CN6 Products	5221	4953	4932	1471
CN8 Products	10,054	9016	8958	4619
Exporter-CN2 Combinations	2660	2572		
Exporter-CN4 Combinations	29,906	24,955		
Exporter-CN6 Combinations	108,295	83,771		
Exporter-CN8 Combinations	183,610	133,439		

… to the aggregate

Individual dummies

EU28 cross-section

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	$y = p, q$	$y = p, q$	$y = p, q$	$y = p, q$	$y = p, q$	$y = p, q$	$y = p, q$	$y = p, q$	$y = p, q$	$y = p, q$	$y = p, q$	$y = p, q$	$y = p, q$
Exporter FE	YES												
CN2 Product FE		YES											
CN4 Product FE			YES										
CN6 Product FE				YES									
CN8 Product FE					YES								
Exporter-CN2 FE						YES							
Exporter-CN4 FE							YES						
Exporter-CN6 FE								YES					
Exporter-CN8 FE									YES				
Importer-CN2 FE										YES			
Importer-CN4 FE											YES		
Importer-CN6 FE												YES	
Importer-CN8 FE													YES
Goodness of fit													
Price reg. R^2	1.5%	20.9%	34.6%	40.4%	43.2%	24.7%	41.7%	51.9%	57.4%	23.6%	40.4%	50.8%	56.5%
Quantity reg. R^2	0.3%	2.9%	5.4%	7.2%	8.4%	3.9%	8.7%	13.3%	16.6%	9.6%	16.5%	24.6%	31.0%
Q.per Capita reg. R^2	0.3%	3.2%	5.9%	7.7%	9.1%	4.3%	9.1%	13.7%	17.3%	11.3%	19.5%	28.0%	34.9%
Q.per GDP reg. R^2	0.3%	3.2%	7.0%	9.7%	11.5%	4.6%	11.1%	17.0%	21.5%	13.5%	24.7%	34.4%	40.8%
F-tests													
Price reg. F	1213.25	5830.05	911.90	286.69	176.41	267.74	59.26	25.93	19.79	52.56	14.44	6.73	5.22
Quantity reg. F	206.29	651.10	98.91	33.01	21.37	33.35	7.86	3.68	2.93	18.18	4.21	2.12	1.80
Q.per Capita reg. F	222.67	735.78	107.63	35.29	23.13	36.71	8.26	3.81	3.08	21.64	5.15	2.54	2.15
Q.per GDP reg. F	239.29	720.55	129.87	45.28	30.07	39.13	10.38	4.93	4.02	26.59	6.99	3.41	2.77

Analysis of Variance

ANOVA in regressions with two sets of dummies,

for EU28 cross-section

Mean Sum of Squares in price regressions ($y = p$)				
	(1)	(2)	(3)	(4)
Exporter-CN2 FE	9.39E+07			
Exporter-CN4 FE		5.31E+07		
Exporter-CN6 FE			4.08E+07	
Exporter-CN8 FE				3.85E+07
Importer-CN2 FE	3.14E+07			
Importer-CN4 FE		2.03E+07		
Importer-CN6 FE			1.65E+07	
Importer-CN8 FE				1.57E+07
Mean Sum of Squares in quantity regressions ($y = q$)				
	(1)	(2)	(3)	(4)
Exporter-CN2 FE	2.11E+09			
Exporter-CN4 FE		1.11E+09		
Exporter-CN6 FE			8.89E+08	
Exporter-CN8 FE				8.50E+08
Importer-CN2 FE	1.77E+09			
Importer-CN4 FE		1.07E+09		
Importer-CN6 FE			8.89E+08	
Importer-CN8 FE				8.63E+08

and for Belgian exports

Mean Sum of Squares in price regressions ($y = p$)			
	(1)	(2)	(3)
Variety FE	3.35E+07	3.03E+07	3.04E+07
Country CN2 FE	6.53E+06		
Country CN4 FE		8.48E+06	
Country CN6 FE			8.35E+06
Mean Sum of Squares in quantity regressions ($y = q$)			
	(1)	(2)	(3)
Variety FE	3.57E+09	2.49E+09	2.50E+09
Country CN2 FE	2.47E+09		
Country CN4 FE		2.82E+09	
Country CN6 FE			2.66E+09

Analysis of Variance

ANOVA in regressions with two sets of dummies,

for EU28 cross-section:

Very similar levels of variability explained, per regressor

	Mean Sum of Squares in price regressions ($y = p$)			
	(1)	(2)	(3)	(4)
Exporter-CN2 FE	9.39E+07			
Exporter-CN4 FE		5.31E+07		
Exporter-CN6 FE			4.08E+07	
Exporter-CN8 FE				3.85E+07
Importer-CN2 FE	3.14E+07			
Importer-CN4 FE		2.03E+07		
Importer-CN6 FE			1.65E+07	
Importer-CN8 FE				1.57E+07
	Mean Sum of Squares in quantity regressions ($y = q$)			
	(1)	(2)	(3)	(4)
Exporter-CN2 FE	2.11E+09			
Exporter-CN4 FE		1.11E+09		
Exporter-CN6 FE			8.89E+08	
Exporter-CN8 FE				8.50E+08
Importer-CN2 FE	1.77E+09			
Importer-CN4 FE		1.07E+09		
Importer-CN6 FE			8.89E+08	
Importer-CN8 FE				8.63E+08

Dummy Regressions

Regressions results with two sets of dummies,

for EU28 cross-section

	(1) $y = p, q$	(2) $y = p, q$	(3) $y = p, q$	(4) $y = p, q$
Exporter-CN2 FE	YES			
Exporter-CN4 FE		YES		
Exporter-CN6 FE			YES	
Exporter-CN8 FE				YES
Importer-CN2 FE	YES			
Importer-CN4 FE		YES		
Importer-CN6 FE			YES	
Importer-CN8 FE				YES
Goodness of fit				
Price regression R^2	27.1%	46.8%	61.0%	68.8%
Quantity regression R^2	11.1%	20.8%	32.8%	42.8%
Q per capita regression R^2	12.5%	22.9%	34.6%	44.4%
Q per GDP regression R^2	11.2%	22.9%	33.7%	41.3%
Number of observations	2,100,204	2,100,204	2,100,204	2,100,204
Number of dummies	14,822	119,155	363,510	552,459
F tests				
Price regression F	52.25	14.61	7.46	6.19
Quantity regression F	17.57	4.36	2.33	2.09
Q per capita regression F	20.02	4.93	2.53	2.23
Q per GDP regression F	17.73	4.94	2.43	1.97

Dummy Regressions

Regressions results with two sets of dummies, product by product, for EU28 cross-section:

	(1) Weighted averages		(2) R^2 for Price >Quantity		(3) Simple averages		(4) Number of products
Market dummy:	land-CN8	land	land-CN8	land	land-CN8	land	
by CN2							96
Price R^2	**55.2%**	**41.3%**	.	.	**57.7%**	**43.3%**	
Quantity R^2	37.1%	20.1%	89.6%	93.8%	39.8%	22.6%	
Q per capita R^2	40.7%	21.8%	85.4%	92.7%	43.7%	24.5%	
Q per unit of GDP R^2	38.1%	19.5%	92.7%	95.8%	40.4%	22.7%	
by CN4							1133
Price R^2	**43.1%**	**31.8%**	.	.	**51.9%**	**43.0%**	
Quantity R^2	32.0%	21.0%	79.1%	77.8%	40.3%	31.1%	
Q per capita R^2	36.0%	23.7%	68.0%	68.9%	45.3%	35.5%	
Q per unit of GDP R^2	32.4%	21.1%	80.8%	79.0%	39.3%	30.9%	
by CN6							4933
Price R^2	**58.3%**	**50.8%**	.	.	**50.3%**	**47.7%**	
Quantity R^2	46.0%	39.3%	77.0%	76.5%	40.6%	38.0%	
Q per capita R^2	52.4%	45.3%	62.3%	61.6%	46.0%	43.4%	
Q per unit of GDP R^2	45.6%	39.6%	78.8%	77.4%	37.8%	35.7%	
by CN8							8913
Price R^2	**75.9%**	**75.9%**	.	.	**51.6%**	**51.6%**	
Quantity R^2	62.5%	62.5%	74.6%	74.6%	42.9%	42.9%	
Q per capita R^2	71.8%	71.8%	59.9%	59.9%	48.2%	48.2%	
Q per unit of GDP R^2	60.9%	60.9%	79.9%	79.9%	37.5%	37.5%	

Quantities are systematically more volatile than prices!

(even if with micro data this was more evident)

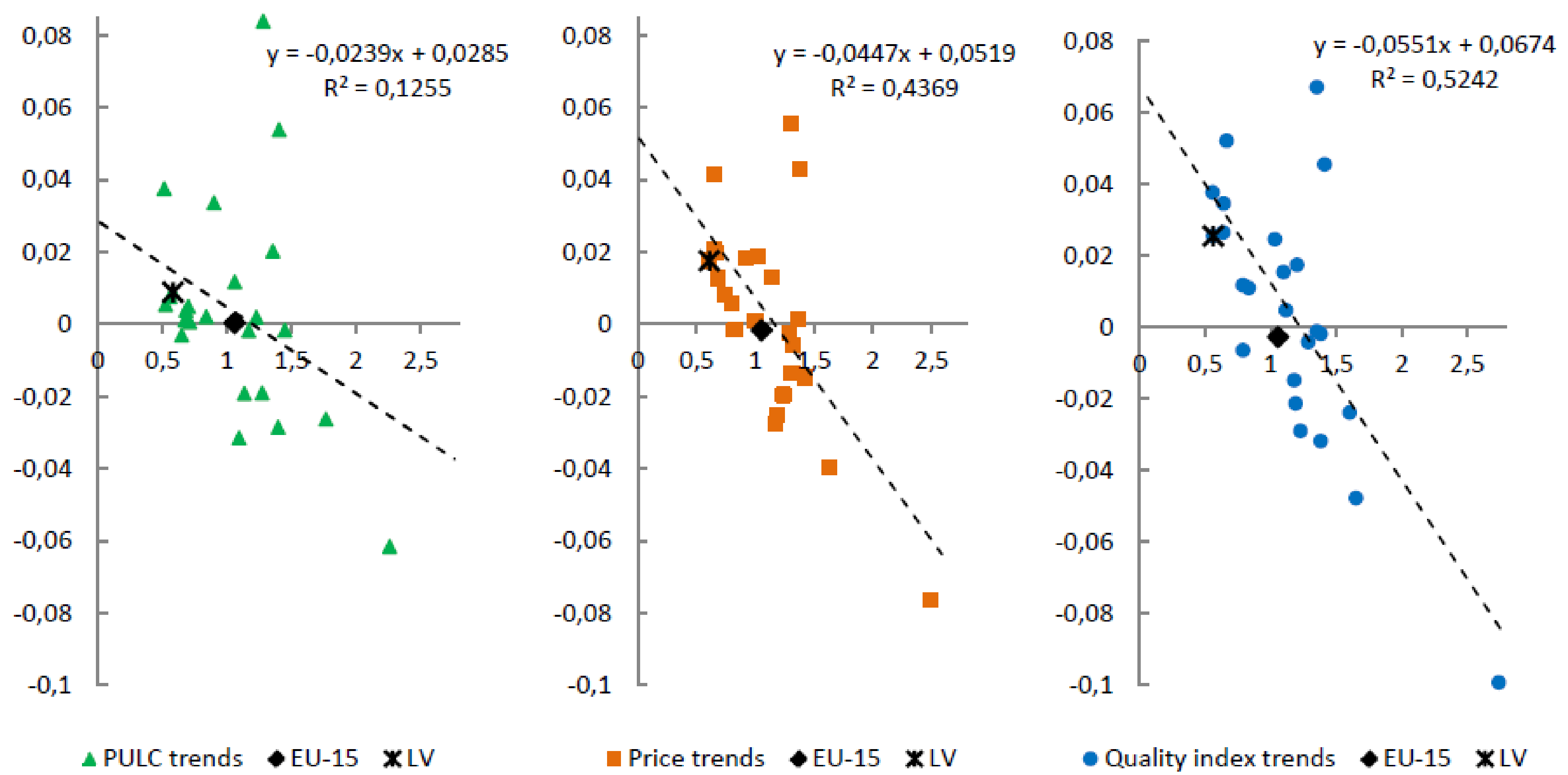
Dummy Regressions

Regressions results with two sets of dummies within different industry categories, for EU28 cross-section:

INDUSTRIES (*corresponding CN2 product codes*)	(1) R^2 of price regression	(2) R^2 of quantity regression	(3) Number # of Observations	(4) Model degrees of freedom
Agriculture *CN2 codes 1 to 15*	52.85%	25.16%	131,190	15,382
Food, beverages *CN2 codes 16 to 24*	49.44%	21.63%	131,138	10,077
Minerals, chemicals *CN2 codes 25 to 38*	55.44%	25.93%	242,823	16,098
Plastics and rubber *CN2 codes 39 and 40*	36.93%	24.02%	140,309	7,073
Leather, skins, wood *CN2 codes 41 to 46*	64.16%	23.78%	59,289	5,047
Articles of paper *CN2 codes 47 to 49*	34.11%	26.41%	73,681	4,260
Textile articles *CN2 codes 50 to 63*	53.38%	19.76%	234,486	20,009
Footwear, accessories *CN2 codes 64 to 67*	44.82%	15.74%	25,986	2,176
Construction materials *CN2 codes 68 to 70*	51.07%	23.80%	73,374	4,715
Base metals, jewelry *CN2 codes 71 to 83*	58.75%	26.78%	264,675	17,504
Mechanical appliances *CN2 codes 84 and 85*	50.54%	18.50%	515,179	28,389
Transport equipment *CN2 codes 86 to 89*	58.40%	22.34%	73,957	4,607
Precision instruments *CN2 codes 90 to 93*	51.16%	14.20%	70,847	5,175
Furniture and toys *CN2 codes 94 to 96*	46.48%	19.24%	95,731	5,093

Long-term trends:convergence?

Figure 11: Weighted average physical unit labour costs, price and quality growth (vertical axis) and initial levels (horizontal axis) in the EU Member States



CN2 products - LV example

Figure 10: PULC, price and quality growth (vertical axis) and initial levels (horizontal axis) of Latvian export products