

Unit Values, Unit Labor Costs and Trade Performance in Four Central European Countries

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Main themes

- Motivations, scope, objectives, data sources and some findings
- Stylized facts: aggregate changes in export values, prices, UVs, volumes and ULCs
- Explaining export UVs in trade with Germany – export side
- Dissecting market shares: UVs and quantities – import side
 - UVs and trade performance
- Estimating and decomposing comparative ULC levels: methodology and statistical issues
- Some quantitative results (import side)
 - ULCs and UVs
 - ULCs and trade performance
- Summary and directions for further research

Definitions, abbreviations

- Unit value (UV): value (in euro) per quantity unit (kg)
- Unit labor cost (ULC): labor cost (in euro) per **volume** of value added (W/VAq) →
- Purchasing power Parity (PPP)
- Wage share (WS): the fraction of labor cost in nominal value added (W/VAn)

I. Introduction

Motivations, scope, objectives, data sources

Motivations

- Empirical, conceptual, methodological + statistical,
 - Empirical: understanding strange developments in export prices/volumes in four new EU-states (CZ, HU, PL, SK)
 - Conceptual: dissatisfaction with analyses based solely on changes (index numbers)
 - Market share (performance)
 - RER indices
 - Export price/UV
 - ULC
 - Methodological + statistical
 - Product and industry level data, rather than aggregate statistics
 - Merging data on UV and ULC levels to explain trade performance: new insights?
- Our main point: ***levels matter***
 - Without information on („initial”) levels – no idea whether changes involve convergence or divergence in UVs and ULCs →
 - Different implications for „competitiveness” (change in market share and volumes)

Scope

- 4 NMS of the EU („V4“): CZ, HU, PL, SK (control: AU)
- Period: 2000-2010 (regarding some indicators: 1997-2007 or shorter period)
- Exports to Germany
- Export prices → empirically: UVs – levels and changes
 - Two measures of UV levels/changes
 - Export side (destination)
 - Import side (origin)
- ULC – levels and changes
 - Levels: two measures (double and single deflation)
 - Changes: one measure
- Market share (in Germany’s imports)
 - Two measures
 - Export side (destination)
 - Import side (origin)

Objectives

- Quantify
 - Level and changes of UVs (alternative approaches: own calculations)
 - Level and changes of ULCs (alternative approaches: merging existing databases + own calculations)
 - Market shares and their components (extensive and intensive margin; within the latter: „price” [UV] and quantity margin - own calculations)
- Clarify
 - Is there convergence in levels of the indicators in focus?
 - What „affects” UVs? → (correlations)
 - Relationship between UVs and trade performance
 - Are UVs closer to price or to „performance” (i.e., quality) indicators? (Positive, negative or no relationship between UVs and quantities)
 - Relationship between UVs and ULCs
 - Relationship between ULC and trade performance

Data sources

- UV: Comext „product” (HS-8) level data (both destination and origin side)
- ULC: EU KLEMS (industry level)
 - 1997 levels [Inklaar – Timmer (2008)]^{*/} (industry PPPs) combined with
 - EU KLEMS nominal levels and indices (1997-2007)
 - Levels normalized so that Germany = 1 (rather than US=1)

^{*/}Inklaar, Robert – Timmer, Marcel P. (2008): GGDC Productivity Level Database: International Comparisons of Output, Inputs and Productivity at the Industry Level. EU KLEMS Working Paper Series, nr. 40, European Commission, August 2008.

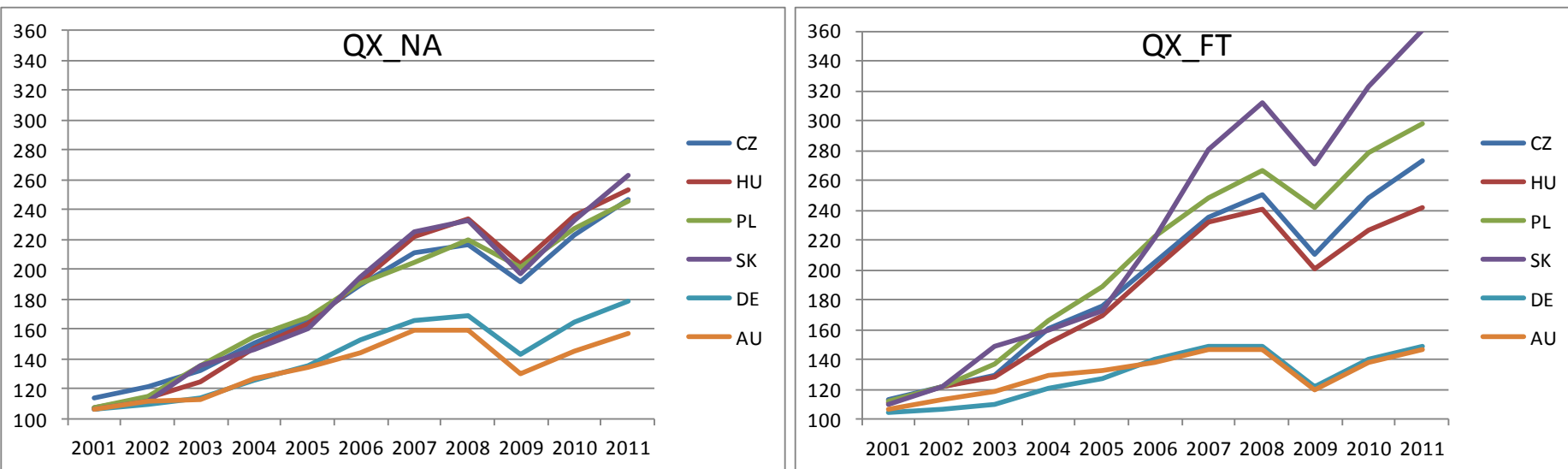
Findings

- General: there is no such thing as „*the*” level of UVs and ULCs
 - UVs
 - alternative weighting schemes
 - Export or import statistics
 - ULCs
 - Volume comparisons based on double or single deflation
 - Having alternative measures is better than having none (though sometimes confusing)
- Specific (to be addressed)
 - Convergence
 - UVs and market shares
 - ULCs and UVs
 - ULCs, market shares and quantity margins

II. Stylized facts

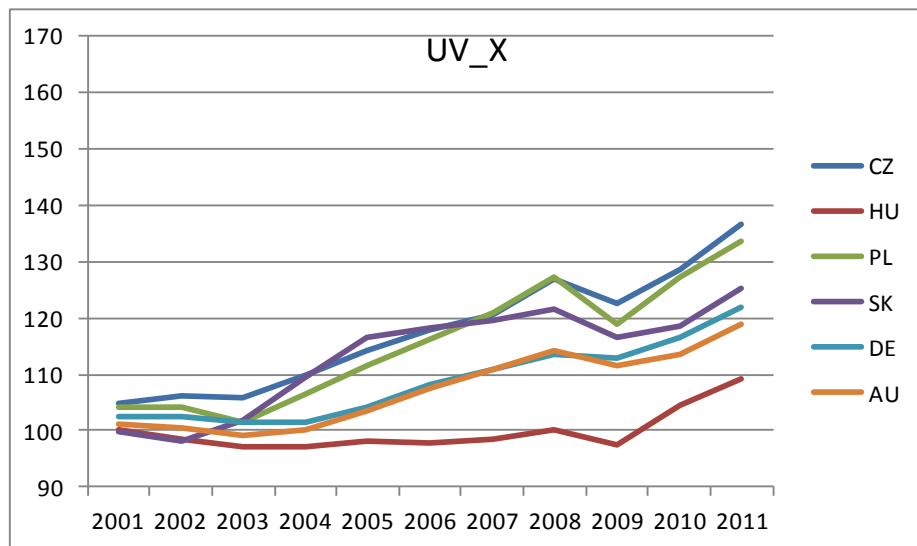
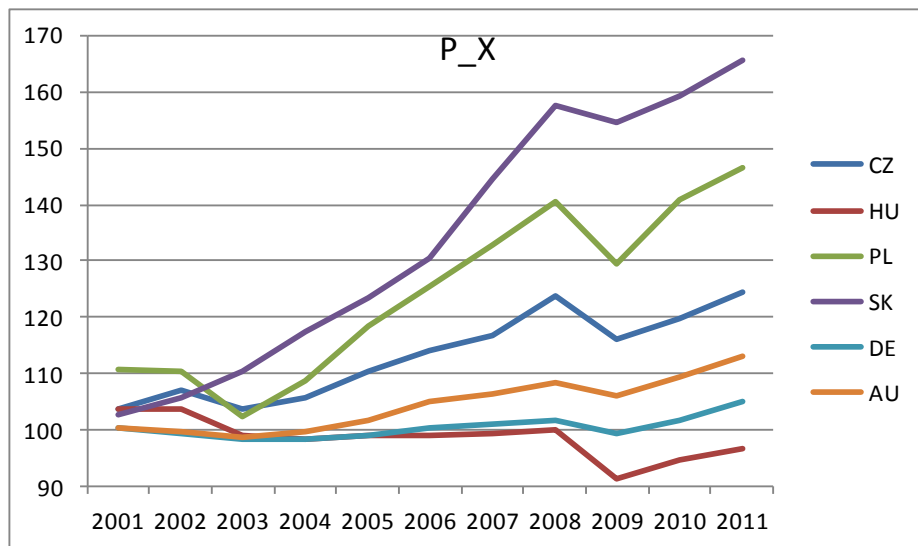
- Export volume indices (two types)
- Price and UV indices
 - Aggregate
 - Relative to German imports
- ULC-based RER indices and ULC levels

Volume indices of exports of goods, based on national accounts data (left pane) and international trade data (right pane), 2000=100



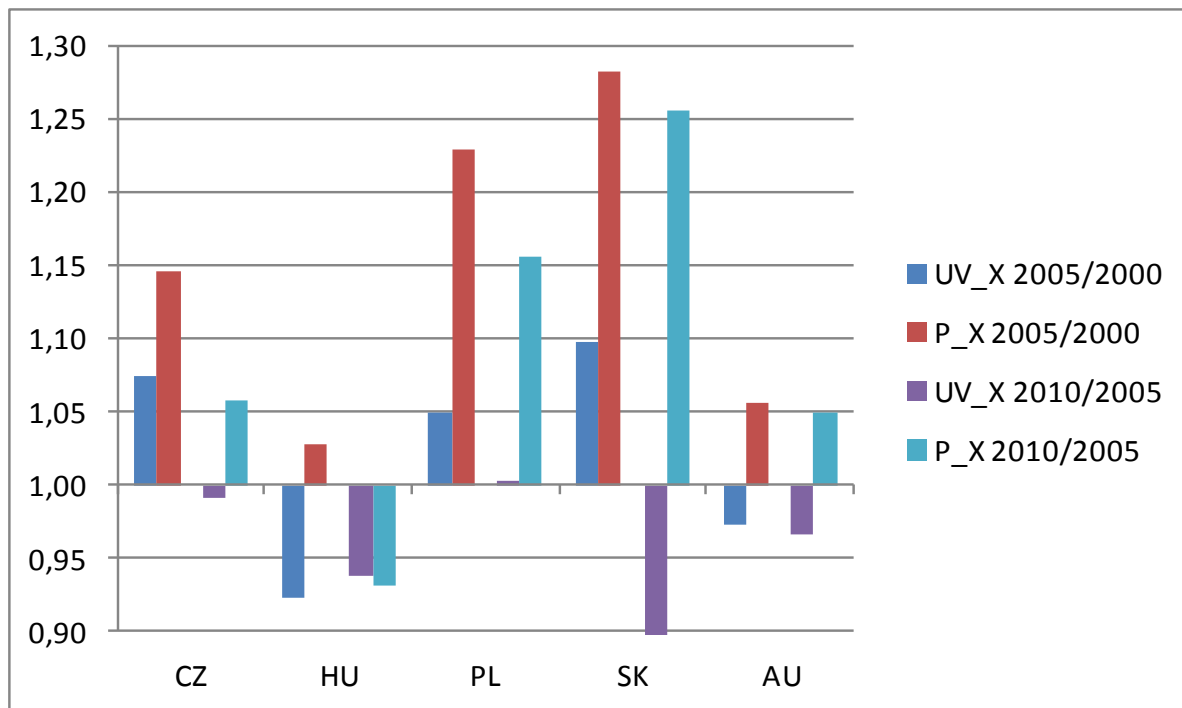
Source: Eurostat: databases on national accounts and international trade.

Export price indices (deflators) from national accounts (left pane) and unit value indices from international trade data (right pane) in euros, 2000=100

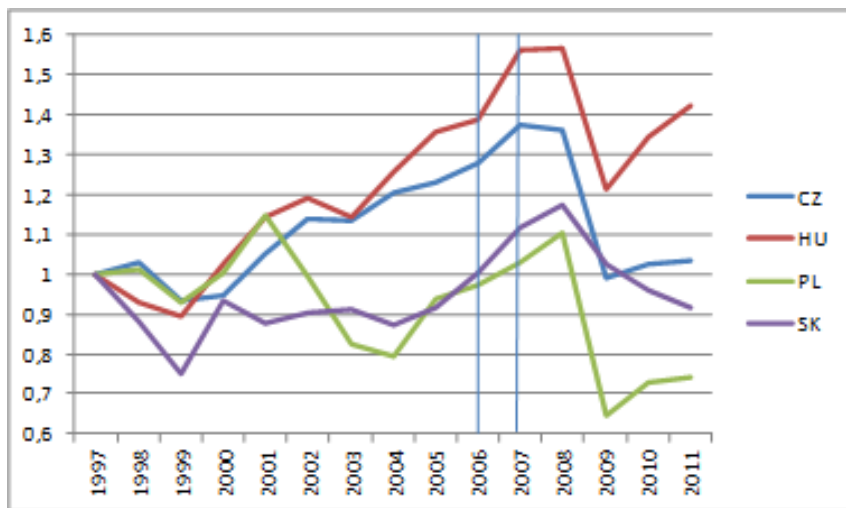


Source: Eurostat databases on national accounts and international trade.

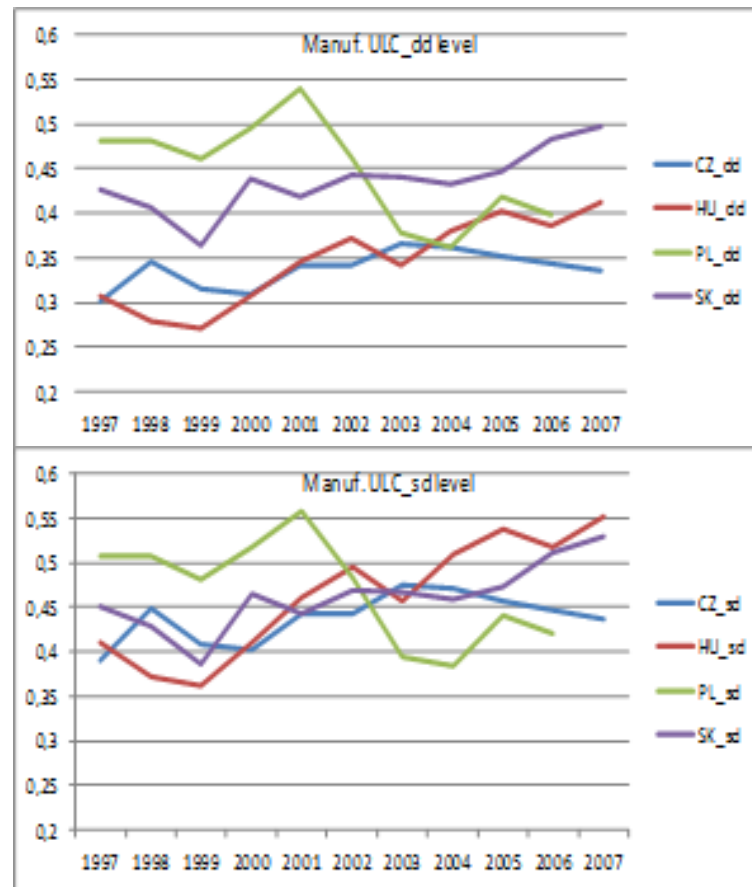
Changes in unit values and prices in five countries' exports relative to those in Germany's imports, in the first and second half of the 2000s



Manufacturing ULCs: relative changes (1997=1; left hs) and comparative levels (right hs: two approaches) - relative to Germany



Source: own calculations based on the real exchange rate index database of DG ECFIN of the European Commission



Source: own calculations

III. UV levels in exports to Germany: description and „explanation” (origin side)

- Description
- Convergence?
- Explanation

Relative unit value levels in exports to Germany, compared to Austria (common bundle)

	P2005, w2005	P2010, w2005	P2010, w2010	<i>total</i>	<i>within</i>	<i>volume</i>
Czech. Rep.	0.87	1.00	0.96	1.11	1.16	0.96
Hungary	1.46	1.24	1.28	0.87	0.85	1.03
Poland	0.67	0.78	0.72	1.07	1.16	0.93
Slovakia	1.22	1.50	1.27	1.04	1.22	0.85

- HU's UV level rather high in 2005
- Using 2005 weights helps to dissect the total change into a
 - within (i.e., unchanged weights) and
 - volume (i.e., change in volume of goods sold) component
- Relative UVs of CZ, PL and SK increased by 16-22%, but: rebalancing towards lower unit value products (below 1 values in the "volume" column)
- HU's UVs fell markedly, with a slight move towards larger sales in higher UV goods

Is there convergence in UV levels?

We estimate the change in log unit value (dUV) as a function of the 2005 level of UV, country (c=HU, SK, CZ, PL) and industrial sector dummies (s=1...13). We both estimate on the full sample and separately for each country.

$$d(UV)_{ic} = \alpha + \beta UV_{2005} + \theta_c + \epsilon_s + \varepsilon$$

Estimated UV convergence values: *clear evidence of convergence*

	I. Simple OLS			II. Value weighted OLS		
	Est. Coeff.	s.e.	R ²	Est. Coeff.	s.e.	R ²
Full sample	-0.0961***	0.0110	0.0671	-0.0695***	0.0065	0.1143
Hungary	-0.0466**	0.0188	0.0304	-0.0764***	0.0162	0.1741
Czech Rep	-0.0729***	0.0169	0.0924	-0.0285**	0.0113	0.0570
Slovakia	-0.1613***	0.0301	0.0716	-0.1513***	0.0207	0.2498
Poland	-0.0850***	0.0177	0.0704	-0.0480***	0.0090	0.1254

Notes: HS8 level data considering only the restricted sample of commonly exported goods. All regressions include industrial sector dummies (based on NACE classification), the full sample regression also have country dummies. Panel II includes regressions with weights of 2005 export values in euro. *** p < 0,01, ** p < 0,05, * p < 0,1

Further results from the export side: „Explaining” UVs

- Results suggest that there is a negative relationship between quantity and unit value
- We find strong evidence that a larger market size allows for higher UVs
- Cost factors (i.e, ULC and WS) do not seem to be significant (but without industry/country dummies, they are)

IV. Dissecting market shares (2000-2010)

- In Germany's imports from the EU
- Two components (Hummels-Klenow decomposition)
 - Extensive margin
 - Intensive margin, including
 - Relative UV level
 - Relative quantity level
- Effect of UVs on market shares/quantities?

Methodology

When implementing the decomposition we compare the exports (to Germany, DE) of country j to that of the EU27. We decompose the share of country j in total EU27 exports to Germany (s_j^{DE}) into three margins: the extensive margin (EM_j^{DE}) the unit value margin (P_j^{DE}) and the quantity margin (X_j^{DE}):

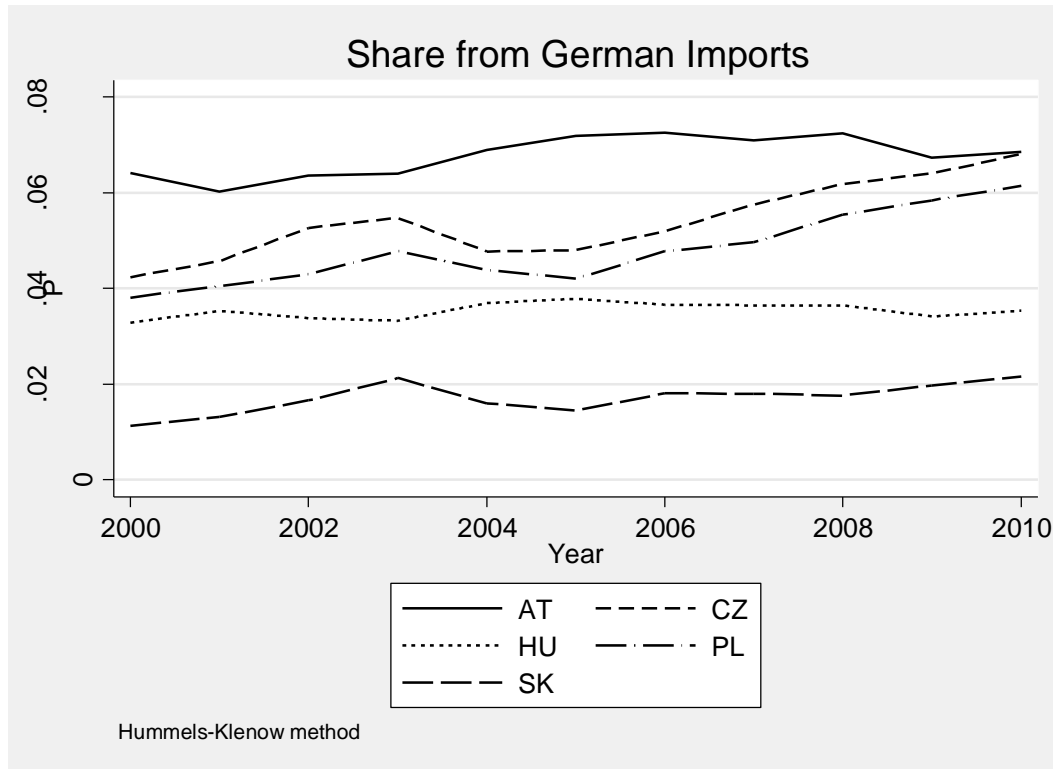
$$s_j^{DE} = EM_j^{DE} P_j^{DE} X_j^{DE}$$

where

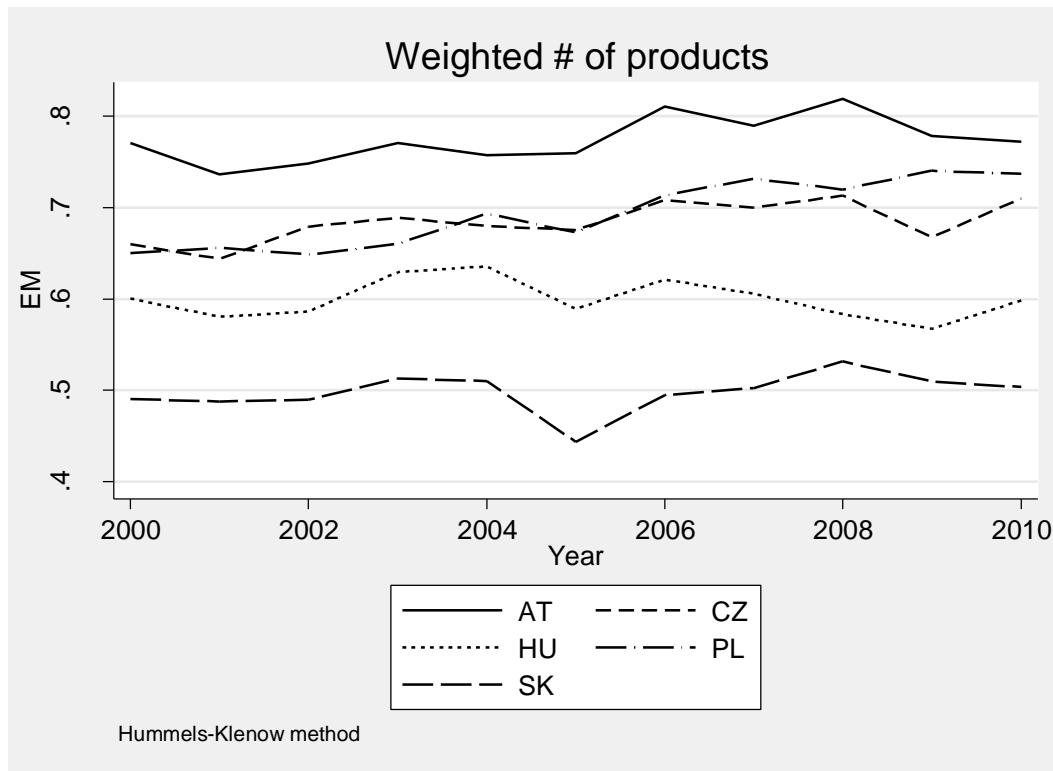
$$s_j^{DE} = \frac{\sum_{i=1}^I p_{j,i}^{DE} x_{j,i}^{DE}}{\sum_{i=1}^I p_{EU,i}^{DE} x_{EU,i}^{DE}}$$

where i indexes indicate 8-digit products, $p_{EU,i}^{DE}$ and $x_{EU,i}^{DE}$ represents the unit value and the quantity exported from product i to Germany by the rest of the EU, respectively. (See details in our paper).

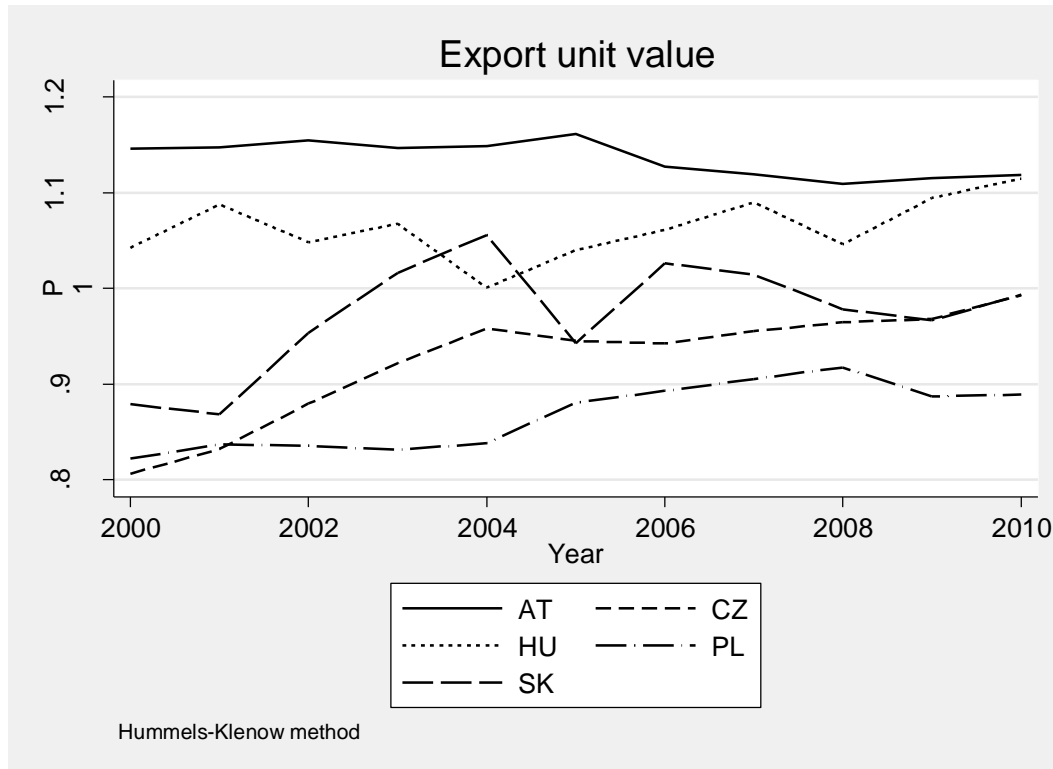
Shares



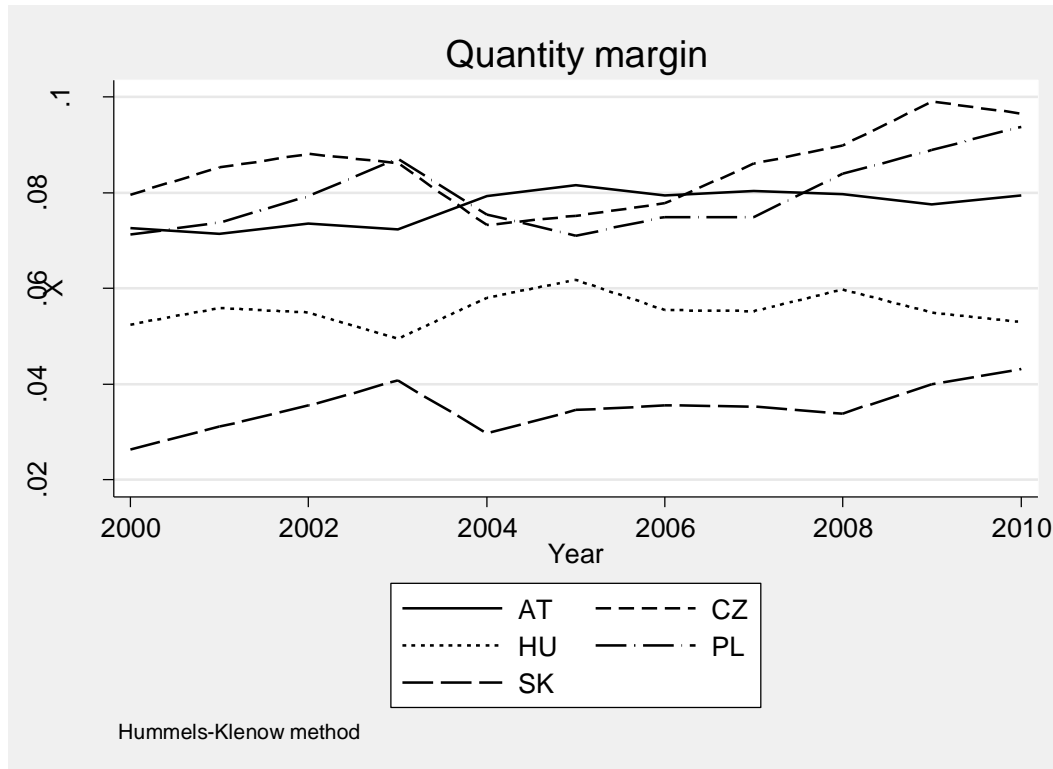
Extensive margin



Unit values



Volumes



Discussion

- CZ and SK exports increased significantly during the 2000s
 - This is decomposed to a strong growth in all margins: CZ quantities and UVs have grown in parallel (quality upgrading?)
 - A similar pattern can be observed in the Polish case, with the difference that export unit values were still relatively low in 2010. Quality of Polish exports may have increased, but it still seems to be lower than that of the other countries under study.
- In contrast, Hungarian share on the German market stagnated during the second half of the 2000s.
 - The decomposition suggests relatively high and increasing Hungarian UVs together with relative stagnation of quantities.

The relation between UVs and market shares/quantities by industry

- We estimate

1. in cross sections: levels

$$s_{jk}^{DE} = \beta P_{jk}^{DE} + \mu_j + \eta_k + \varepsilon_{jk}$$

$$X_{jk}^{DE} = \beta P_{jk}^{DE} + \mu_j + \eta_k + \varepsilon_{jk}$$

2. changes with lagged („initial”) price levels

- In each regression we include all five countries (V4+AU); industry + country dummies

Results (1)

	Dependent variable: market share							
VARIABLES	2000	2001	2002	2003	2004	2005	2006	2007
Unit value	-0.037	-0.027	-0.032	-0.032	-0.024	-0.019	-0.060*	-0.027
	(0.028)	(0.027)	(0.027)	(0.030)	(0.027)	(0.025)	(0.030)	(0.025)
Observations	65	65	65	65	65	65	65	65
R-squared	0.631	0.624	0.650	0.573	0.569	0.575	0.637	0.636
	Dependent variable: quantity margin							
Unit value	-0.120***	-0.103***	-0.098**	-0.083*	-0.104***	-0.076**	-0.136***	-0.080**
	(0.041)	(0.036)	(0.038)	(0.045)	(0.038)	(0.035)	(0.042)	(0.032)
Observations	65	65	65	65	65	65	65	65
R-squared	0.544	0.571	0.579	0.468	0.507	0.469	0.558	0.567

Notes: HS8 level. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

(Coefficients of country and industry dummies not reported here)

- UVs are strongly negatively correlated with the quantity margin - reflecting an underlying demand function
- The country-industry level market shares are not correlated with UVs (market shares include the product of unit values and quantities, which cancel each other out)

Results (2)

- How initial values (from 2000) of the different variables affected the change of each margin between 2000 and 2007? (tables not reported here; see p. 32 in the text)
- UVs: we can observe convergence: UV growth between 2000 and 2007 is negatively related to UV level in 2000
- Smaller 2000 market share was associated with smaller growth in unit values, suggesting that worse initial competitive position hindered firms in increasing UVs (prices)
 - These results are not robust to the inclusion of country dummies
- Larger initial share is associated with larger growth in market share.
- An increase in UV between 2000 and 2007 is associated with an increase in the extensive margin, but a decrease in the quantity margin.
 - These results are robust to the inclusion of country dummies.

V. Comparative ULC levels at the industry level in the 4 countries

- Estimation and decomposition of ULCLIs (unit labor cost level indices) – two approaches
- Is there convergence in ULCLIs (its components)?
- The relationship between ULCLIs and
 - UVs
 - trade performance

Calculating ULCLIs

- W/VA_q : nominal labor cost/*volume* of VA (for international comparisons: PPPs are required)
 - simple for GDP (PPPs available from several sources)
 - industry level PPPs: available from one source, for only 1997 [Inklaar – Timmer (2008)]
 - Combine 1997 productivity level indices with labor cost data in EU KLEMS: ULCLIs for 1997 (rebase so that Germany=1)
 - Combine benchmark levels with indices for 1998-2007: time series at constant PPPs
- Two series for each country: „double” and „single deflated”

Two decompositions of ULCLIs

- The *product* of comparative wage shares and comparative price levels between countries (in logs):

$$ulcli_{ij/Rj} = [(w_{ij} - e_{i/R}) - (van_{ij} - ppp_{ij/Rj})] - (w_{Rj} - van_{Rj}) = \\ [(w_{ij} - van_{ij}) - (w_{Rj} - van_{Rj}) + (ppp_{ij/Rj} - e_{i/R})]$$

[The third term is the comparative price level index, CPLI]

- The *ratio* of comparative labor costs per unit of labor to comparative labor productivities

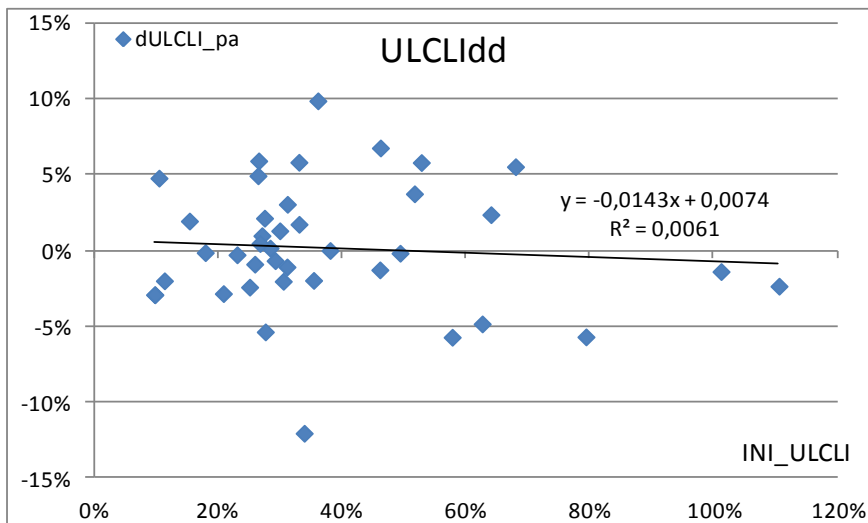
$$ulcli_{ij/Rj} = [(w_{ij} - e_{i/R} - l_{ij}) - (w_{Rj} - l_{Rj})] - [(van_{ij} - ppp_{ij/Rj} - l_{ij}) - (van_{Rj} - l_{Rj})]$$

- The first term in square brackets is the relative nominal labour cost per labour input in a common currency (the relative labor cost rate);
- the second term is relative value added at prices of the reference country per unit of labor input (relative labor productivity).

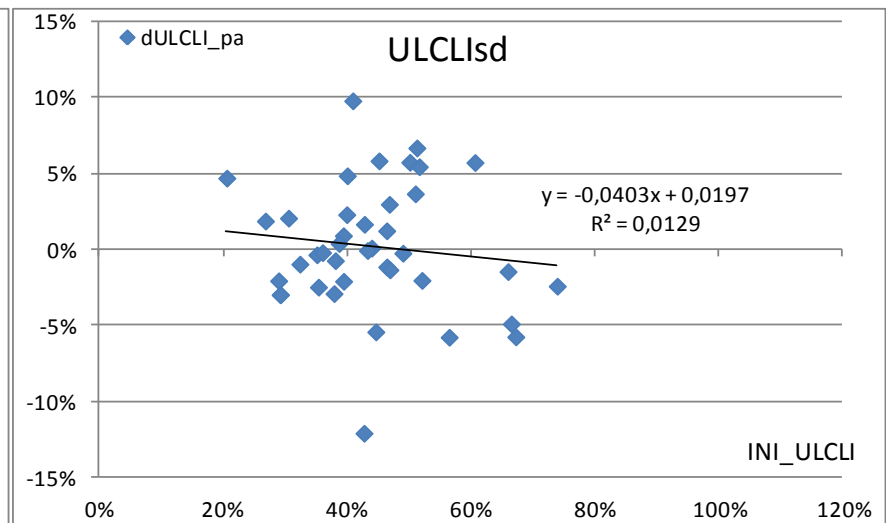
Is there convergence in ULCLIs? – Not really

Changes in ULCs vs. their initial (1997) levels

Double deflation



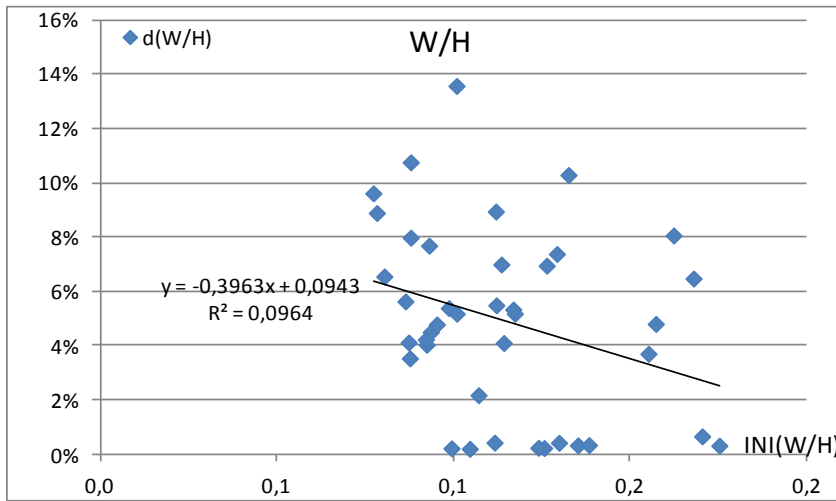
Single deflation



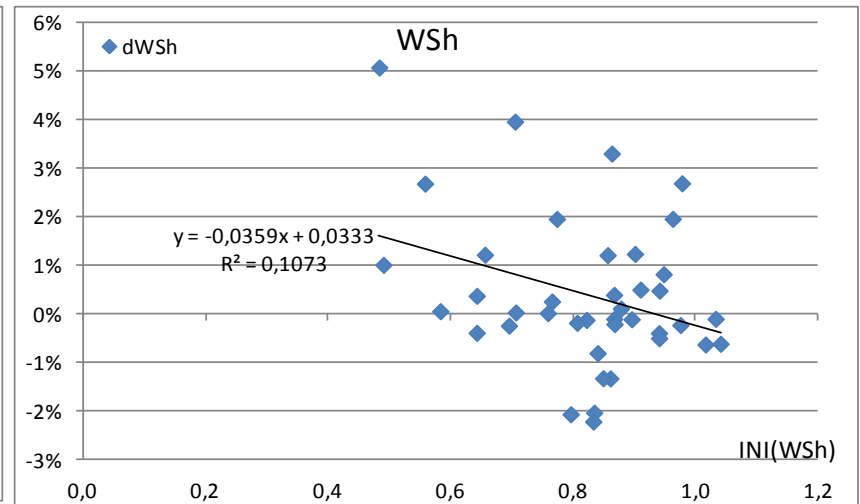
Notations: dULCLI_pa: annual average change in ULC; INI_ULC: ULCLIs in 2007

Is there convergence in the components of ULCLIs? Yes and no

Relative labor costs



Relative wage shares



However:

Industry-level labor productivities and comparative price levels do not show convergence

ULC and UV levels

- Very briefly: no significant relation between ULC and UV levels in cross sections (similar result from export-side)
 - However:
 - small sample size
 - rigorously avoiding „hand picking” from double/single deflated series – even where one of the two was clearly implausible
- Less briefly:
 - Initial ULC level is a significant explanatory variable of UV change (with a negative sign)

ULC and export performance – controlling for initial levels

- The increase in ULC is negatively associated with the change in market share
- There is a clear negative relationship between volume change and the change in ULC

VI. Summary and directions for further work (1)

- There is convergence in the four countries' export UV levels in trade with Germany
- Changes in UVs were positively correlated with changes in ULCs
- A higher UV increase was associated with lower growth in export volume (UVs closer to prices than to quality)
- The level of ULC and that of labor productivity does not show convergence, but the level of labor costs and wage shares do
- The results indicate that our approach helps understanding factors contributing to changes in UVs, as well as trade performance of countries
- However, to reach more general results, the approach should be extended to more countries and markets.

Summary and directions for further work (2)

- Changes in trade performance indicators should be viewed in light of relative levels
- Unfortunately, there are multiple indicators of relative levels
- Having more is better than having none
- Judgment (economic reason) may be important in selection among indicators
- We did not select – a possible reason for some results (e.g., relation between UV and ULC levels)

A final remark

- Our endeavor to combine foreign trade UVs with productivity and ULC level data is in line with the effort to create the “next generation” of the Penn World Tables (Feenstra et. al., 2012)
- The most important innovations to the PWT consist of the inclusion of comparative price levels for exports and imports, as well as including international volume comparisons from the industry side
- Our study – based on similar data, albeit on a limited dataset – indicates the types of analyses that may be performed for a broader group of countries, once the next generation of PWT becomes accessible.