EFIGE IS A PROJECT DESIGNED TO HELP IDENTIFY THE INTERNAL POLICIES NEEDED TO IMPROVE EUROPE'S EXTERNAL COMPETITIVENESS

László Halpern and Balázs Muraközy

Price dispersion in trade with EU countries

EFIGE working paper 15
October 2009

Funded under the Socio-economic Sciences and Humanities Programme of the Seventh Framework Programme of the European Union.

LEGAL NOTICE: The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 225551. The views expressed in this publication are the sole responsibility of the authors and do not necessarily reflect the views of the European Commission.

European Firms In a Global Economy EFIGE

SEVENTH FRAMEWORK PROGRAMME

The EFIGE project is coordinated by Bruegel and involves the following partner organisations: Universidad Carlos III de Madrid, Centre for Economic Policy Research (CEPR), Institute of Economics Hungarian Academy of Sciences (IEHAS), Institut für Angewandte Wirtschafts-forschung (IAW), Centro Studi Luca D'Agliano (Ld'A), Unitcredit Group, Centre d'Etudes Prospectives et d'Informations Internationales (CEPII).

The EFIGE partners also work together with the following associate partners: Banque de France, Banco de España, Banca d'Italia, Deutsche Bundesbank, National Bank of Belgium, OECD Economics Department.

Price dispersion in trade with EU countries[1]

This version: 30 September 2009

László Halpern[2] and Balázs Muraközy[3]

Abstract

In this paper we analyse export unit values exploiting a very detailed annual trade data for Hungary at the firm-product-destination level for 1995-2003. By normalising unit values at the 6-digit product level we concentrate on within-product price variation. After presenting descriptive statistics on price dispersion, we estimate the share of the variation explained by destination and firm-level heterogeneity. Then we focus on firm-level heterogeneity, and estimate the relationship between the most important firm-level variables and export unit values. Finally, we estimate gravity-type equations to model the geographical patterns in export prices.

JEL: D40 F12

Keywords: price dispersion, trade, Hungary

1 This paper is produced as part of the ‘European Firms in a Global Economy: Internal policies for external competitiveness (EFIGE)’, a collaborative project funded by the European Commission's Seventh Framework Programme (contract number 225551). It is part of the ’Center for Firms in the Global Economy (CEFIG)’ network, too.

[2] Institute of Economics of Hungarian Academy of Sciences, CEPR, CEU.

[3] Institute of Economics of Hungarian Academy of Sciences.

1. Introduction

Recent theories of international trade emphasise the role of firm heterogeneity and selection in international trade. The literature has shown that an enormous degree of heterogeneity is present in terms of firm productivity and technology. Heterogeneity in terms of export prices, however, has received somewhat less attention. Recently highly disaggregated, firm-product-destination datasets enable us to analyse these questions as well.

The relationship between heterogeneous firm models and export prices received smaller attention in the literature than the question of trade volumes. It is quite clear, however, that in the workhorse model of Melitz (2003), where firms self-select into exporting solely based on their productivity, firms exporting to more distant markets should be more productive, and as a consequence charge lower prices than firms exporting only to nearby markets (see Baldwin and Harrigan, 2007). As a result, it is natural to expect that the average export unit value observed on smaller and more distant markets tends to be lower. Recent empirical work, however, suggests the opposite.

One piece of evidence for such interesting trends comes from the decomposition of export volumes to different margins. Bernard et al (2007) decomposes US exports to three margins: log number of exporting firms, log number of exported products and log export value per product per firm. Interestingly they show that export value per product per firm increases with distance. For European countries, Mayer and Ottaviano (2008) calculates a similar decomposition, but, taking advantage of quantity data, they decompose further the log export value per product per firm into quantity and price components. They find that the price margin is increasing with distance. Bernard et al. (2007) proposes the following explanation: if the cost of exporting depends on quantity and weight, rather than export volume, then distance may be related to the quality composition of goods.

More directly, Baldwin and Harrigan (2007) uses product-level trade data from the U.S. to identify the relationship between distance and export unit values. These authors find a strong positive relationship between distance and unit values. They also propose a model of firms with heterogeneous productivity and quality to explain the observed pattern of zeroes and unit values. Depending on the relationship between firm-level productivity and product quality, it is reasonable to assume that more productive firms export higher quality goods to more distant markets.

On the micro level, Hallak and Sivadasan (2006) studies endogenous quality choice with minimum quality requirements at the export market. It provides micro evidence for higher quality and price of export goods relative to those that are produced for the domestic market for Chile, Columbia and India. Johnson (2007) also models endogenous quality choice, which depends on the productivity level of the firm. The author estimates a model at bilateral product-level data and shows that prices are increasing in distance. Crozet et al. (2009) provides direct evidence for quality sorting of firms by using a sample of French wine makers. These authors are able to assess the quality of wine produced by each firm using two wine guides. They find that high quality producers export to more markets, charge higher prices and sell more in each market.

These models assume two dimensions of heterogeneity: productivity and quality. The two dimensions are not independent; more productive firms tend to produce higher quality goods. As a consequence, more productive and higher quality firms self-select into smaller and more distant markets. As higher productivity would mean lower unit values and higher quality is related to higher prices, the relationship between productivity and export prices depends on the relative importance of these two effects. Most authors assume that the effect of quality on prices is the dominant channel, which means that productivity and export prices are positively correlated.

The previous micro papers start from firm level data. Manova and Zhang (2009), however, use firm-product-destination level data for China. These authors present a number of stylised facts, and compare them with the predictions of different models of heterogeneous firms, concluding that none of them match all of these facts. They find that firms charge higher prices in more distant markets and that more firms export to larger and closer markets. They also find that firms charge higher prices in larger market.

These ‘selection’ models cannot explain the observation, which we present in Chapter 5; that firms charge different prices for the same product on different markets. To explain the differences within firm-product observations, one has to assume some kind of heterogeneity across markets: for example, contrary to the models building on CES functions, the optimal markup may differ across destination markets.

The main model of pricing-to-market in the heterogeneous firm framework is Melitz and Ottaviano (2008), which assumes heterogeneous firms with respect to productivity and a linear demand function instead of CES. As a consequence markups differ across destination markets leading to within-firm differences in prices. The model predicts that firms absorb some of the higher transportation costs to more distant markets, thus f.o.b. export unit value is negatively associated with distance within a firm. Second, as more firms enter to larger markets, stronger competition forces firms to charge lower prices in such markets than in smaller destinations. Consequently the model predicts a negative relationship between market size and unit values. Kneller and Yu (2008) modifies this model to take quality heterogeneity into account. In this model, firms producing higher quality goods have higher unit cost. As a consequence, in contrast to models with only productivity sorting, firms changing a higher price export to more distant and smaller markets. While this matters for selection, the within-firm predictions of the Kneller and Yu (2008) model are compatible with the Melitz and Ottaviano (2008) framework.

The outline of the remaining part of the paper is the following. Section 2 describes our dataset. Section 3 presents descriptive statistics on price dispersion, on the share of the variation explained by destination and firm-level heterogeneity. In Section 4, we focus on firm-level heterogeneity, and estimate the relationship between the most important firm-level variables and export unit values. In Section 5, we estimate gravity-type equations to model the geographical patterns in export prices. Section 6 concludes.

2. Data

The data used for our empirical analysis were obtained from the Customs Statistics. The dataset consists of *all Hungarian exports* between 1992 and 2003. At this phase, however, we concentrate on the data between 1995 and 2003, which represents a post-transition phase. Consequently our results may be interpreted as describing a pattern representative of export-led growth rather than transition. One observation in the database is the export of product i by firm j to country k in year t.[4]

The product dimension of the dataset is highly disaggregated; it is broken down to 6-digit Harmonised System (HS) level. We define a product as a 6-digit category, although using more aggregated (4-digit) categories does not change our results. "Motor cars and vehicles for transporting persons" is an example for a 4-digit category, while "Other vehicles, spark-ignition engine of a cylinder capacity not exceeding 1,500 cc" is an a 6-digit category. Note that in most cases (like in the car example) further disaggregation of the data would not reduce potential quality differences within each category to zero. The dataset includes both

[4] A more detailed description of our data can be found in Békés at el (2009).

export values and quantities at this highly disaggregated level, thus unit values are calculated as the ratio of these two variables. In the analysis, we use log unit values. To handle the enormous heterogeneity present across products, we normalise log unit values at the product level. For this, we calculate the quantity-weighted average export unit values of each 6-digit product for each year, and normalise the raw unit values with this average. In what follows, we build our analysis on log normalised unit values.

In this paper, as standard in the literature, we restrict our attention to manufacturing firms. Theories of heterogeneous firms can be applied in a more straightforward way for direct export of manufacturing firms than to export of services or exports of manufacturing products by wholesalers or retailers. While manufacturing firms sometimes export agricultural products and other primary goods, these exports are not typical, and we exclude them from the analysis.

We drop exports below 2000 USD in order to eliminate some noise. We also drop outliers for which the log difference between average export price is larger than 4 (about 2% of observations). Muraközy and Békés (2009) show that such small and temporary exports behave differently from larger exports and standard trade theories are not able to explain all characteristics of such trade transactions.

In Sections 3 and 4, we restrict our attention to EU-25 countries as most Hungarian exports are directed to these markets, and as a consequence, the presence of outliers is less important in this subsample. We have repeated these calculations for a larger number of destinations (the 50 largest export markets), and we have not found important differences in the statistics. In Section 5, to be able to identify geographical patterns in export prices we extend our investigations to countries outside the EU benefitting from greater variation in distance and GDP. In this exercise, we concentrate on the 50 most important export markets of Hungary.

3. The extent of export price dispersion

To gain a first impression of the extent of unit value dispersion, we estimated the distribution of normalised log unit values for different years. A methodological problem is that some products are only exported by one firm to one country: in such cases, the log normalised unit value is zero by definition. As the share of such transaction may change in time what may affect our results, we excluded products with less than two observations. The estimated density for Hungarian exports is presented in Figure 1, and Figure 2 shows the density for the most important category in Hungarian exports: Machinery.

Figure 1. Kernel density of log normalised unit values for all goods

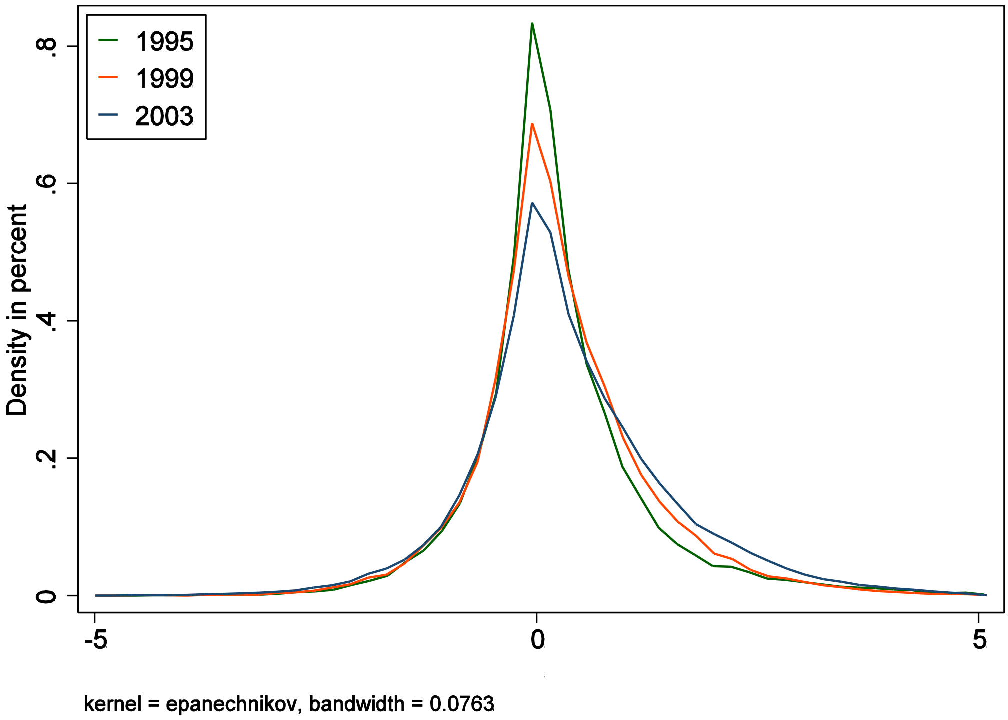
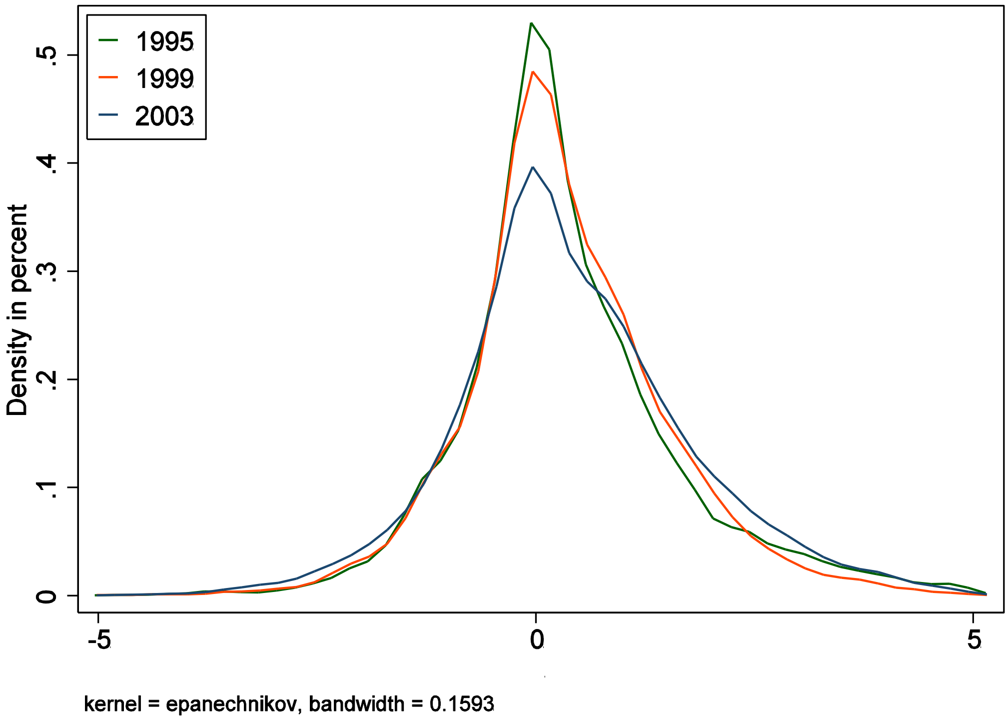


Figure 2 Kernel density of log normalised unit values for machinery



The kernel estimates suggest that price dispersion is quite large in Hungarian exports; normalised log unit values of the magnitude of 2 or 3 are quite frequent in the data. Also, the importance of average-value export transactions decreased, while the number of somewhat higher unit value transactions increased in the period under study, suggesting that the degree of vertical differentiation of Hungarian exports increased in this period.

This is reinforced by Figure 3, which shows two measures of price dispersion for different years: standard deviation and interquartile range. These indicators show some increase, but are unable to reflect all the changes in the shape of the price distribution shown by the kernel estimates.

Figure 3 Price dispersion by year

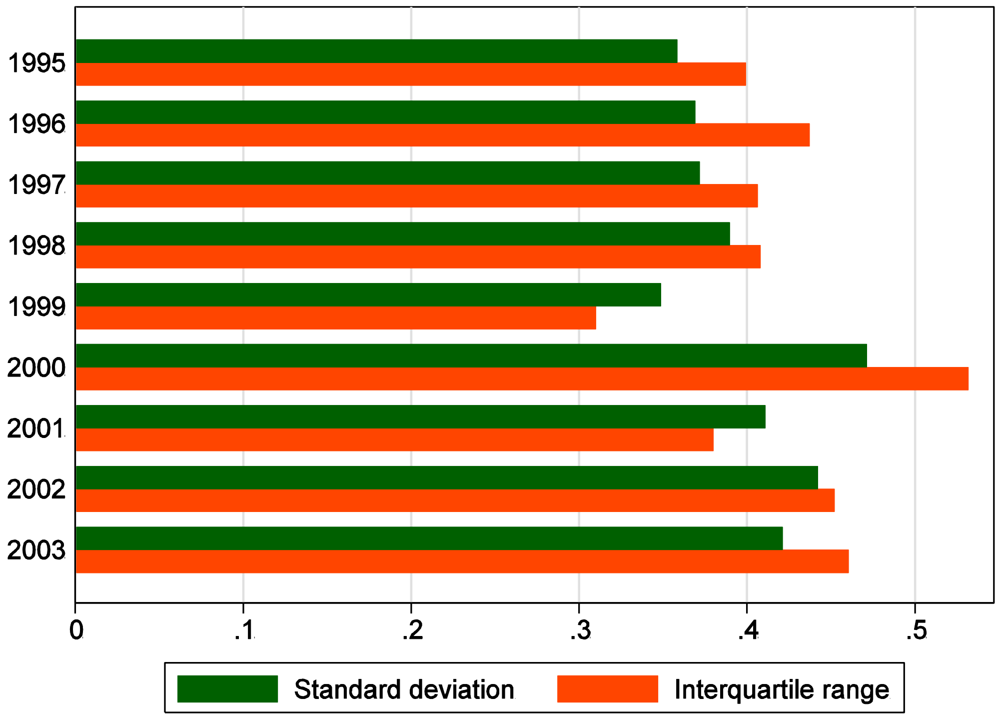


Figure 4. Price dispersion by product category, 2003

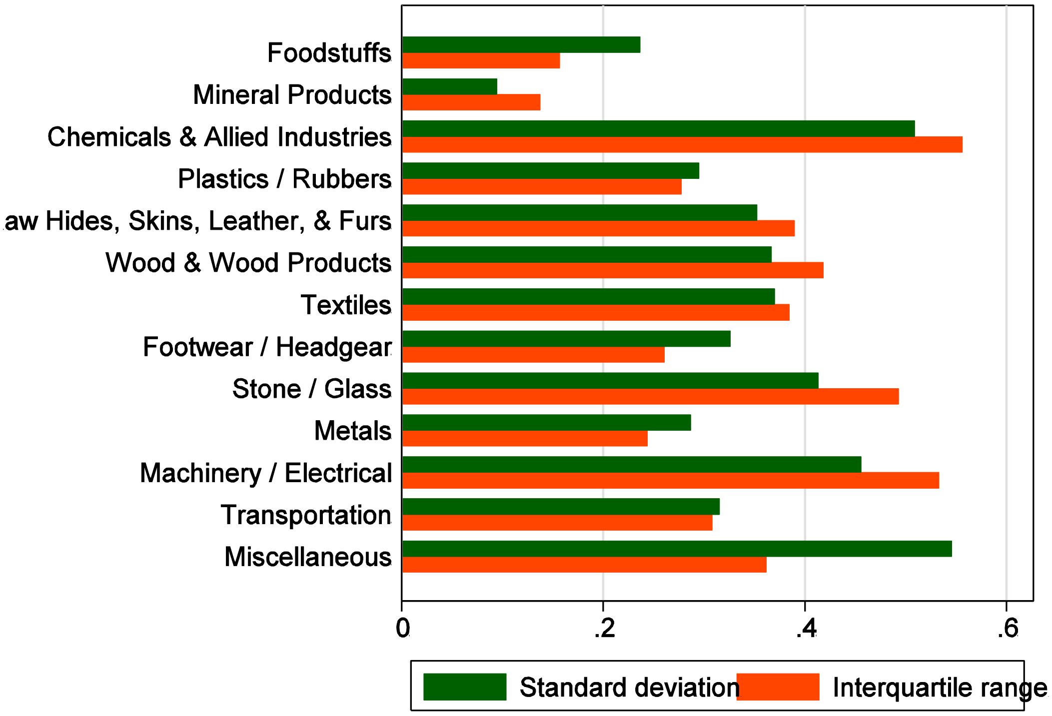
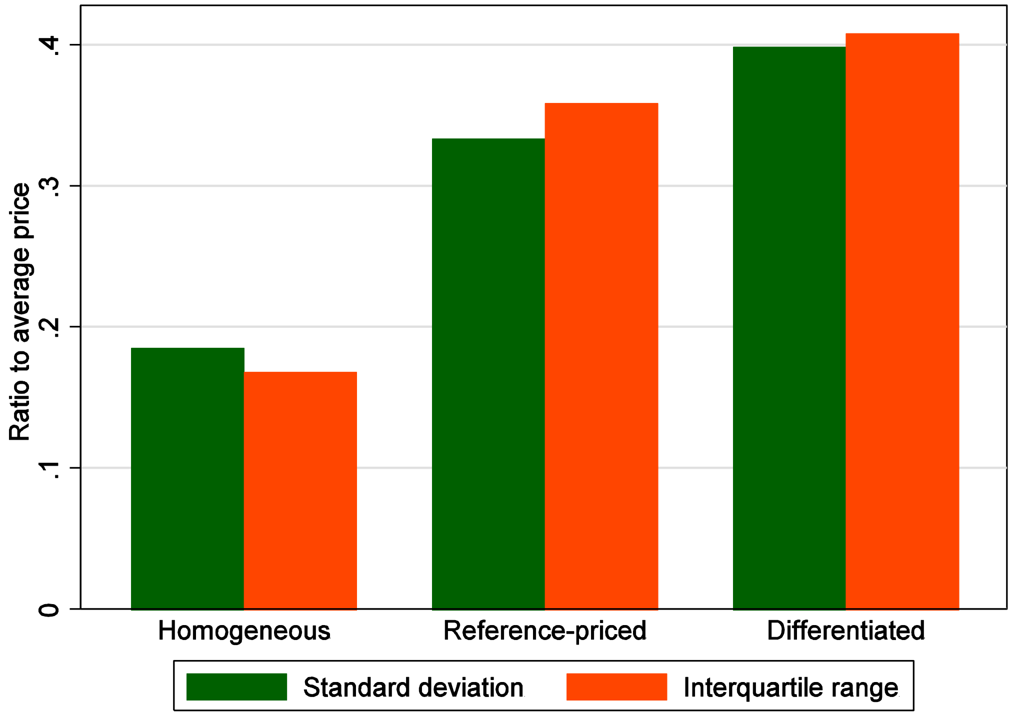


Figure 4 shows the same two measures of price dispersion by main product categories[5]. It shows that price dispersion varies between about 20 and 50% depending on the category of the product. One important product characteristics which determines the extent of price dispersion is whether the product is homogeneous as reflected by Figure 5.[6] Not surprisingly, price dispersion is larger for differentiated products, which is in line with the idea that vertical differentiation is more important for differentiated products.

[5] These Broad Economic Categories (BEC), see http://unstats.un.org/unsd/class/intercop/expertgroup/2007/AC124-8.PDF.

[6] The categories are according to the liberal classification of Rauch (1999).

Figure 5. Price dispersion by homogeneity of the product



All in all, we have shown that price dispersion in Hungarian exports is important even within highly disaggregated product categories. The patterns of price dispersion are quite intuitive. With the appearance of MNEs and trade liberalisation price dispersion increased, suggesting increasing vertical differentiation of Hungarian exports. Also, the inter-industry patterns of price dispersion are as expected; more homogeneous products tend to be less vertically differentiated.

We have to go beyond simple measures of price dispersion for establishing further stylised facts, and have to find variables which are systematically related to export unit values. As we outlined in the Introduction, trade theory suggests two sources of heterogeneity for within-product unit values differences: heterogeneous firms may charge different prices depending on their productivity and quality, or prices may differ across destinations. We estimated the explanatory power of firm- and destination fixed effects what helps quantify the extent of these two sources of heterogeneity. Table 1 shows the results of this decomposition.

Table 1. Share of variation explained by export market and firm fixed effects by product category

Product category	observations	Percentage of variance in unit values explained by	
		country-year FE	firm-year FE
Chemicals & Allied Industries	13254	0.03	0.25
Plastics / Rubbers	21967	0.04	0.40
Raw Hides, Skins, Leather, & Furs	3992	0.08	0.35
Wood & Wood Products	16196	0.05	0.52
Textiles	66684	0.02	0.25
Footwear / Headgear	3655	0.09	0.45
Stone / Glass	7493	0.05	0.46
Metals	31221	0.02	0.35
Machinery / Electrical	64000	0.01	0.27
Transportation	8498	0.03	0.44
Miscellaneous	14574	0.02	0.43

These estimates show that destination market-year fixed effects are only able to explain between 1 and 8 percent from the variation in log normalised unit values. Firm-year fixed effects explain between 20 and 52 percent from the variation. It underlies that firm heterogeneity plays a key role in unit-value differences. However, still about 50 percent of the variance is unexplained – firm fixed effects are not able to capture the multi-product aspect of firms, or firms may sell the same good for different prices, for which we provide evidence in Section 5.

4. Firm-level determinants of unit values

Table 1 illustrates the key role of firm heterogeneity in export unit values. In this Section we aim at finding correlations between firm-level variables and export unit values to explore sources of this heterogeneity. For this we merge the detailed trade data with balance sheet data of firms, and run regressions with log normalised unit value as dependent variable.

The explanatory variables are firm-level variables coming from the balances sheet data. Several variables are included to capture as much from the variation as possible. *Foreign-owned* is a dummy reflecting whether foreign actors own at least 10 per cent of the firm. Foreign-owned firms are more likely to have superior technology and produce higher quality goods, thus we expect that this variable is positively related to unit values. *Employment* shows the log of full-time employees of the firm, which proxies firm size. Inspired by multi-product firm trade models, we also include the *share of the product from the firm's export mix*. If products are sorted according to relative productivity, as in Bernard et al. (2007), products with smaller share would be produced less efficiently by the firm, and could only be sold at a higher price. As a consequence, this model predicts a negative sign for the share of the product.

As productivity plays key role in heterogeneous firm models of international trade, we also include different measures of productivity in our regressions. First, we include *labour productivity* and control for *capital intensity*. We also calculate TFP by two different methods: OLS and the Levinsohn-Petrin estimator. The latter was suggested by Levinsohn and Petrin (2003) and it controls both for unobserved firm heterogeneity and the potential endogeneity of inputs.

Table 2 presents the results of these estimations. It is striking that very little is explained by these observable variables from the variation of unit values compared to the amount explained by firm fixed effects. Also, including TFP changes the point estimates of other parameters, suggesting that size and export share proxies productivity to some extent. These results suggest that more productive and foreign-owned firms charge higher export prices. This relationship is in line with the assumptions of Johnson (2007) that more productive firms tend to produce higher quality goods. Larger firms – when controlling for productivity – tend to ask lower prices. Similarly, products with a higher share in the export bundle tend to have a lower unit value. This finding is in line with the predictions of the Bernard et al. (2007) model. While these are suggesting patterns, their careful interpretation requires further work.

Table 2. Firm-level determinants of log normalized unit value

	(1)		(2)		(3)		(4)	
Foreign-owned	0.069	***	-0.010	**	0.017	***	0.052	***
	0.004		0.005		0.005		0.004	
Employment	-0.005		-0.050	***	-0.432	***	-0.044	***
	0.006		0.007		0.011		0.008	
Share of the product from export mix	-0.038		-0.011		-0.119	***	-0.084	***
	0.023		0.025		0.025		0.028	
Labour productivity			0.119	***				
			0.002					
Capital intensity			0.009	***				
			0.002					
TFP (OLS)					0.101	***		
					0.002			
TFP (LP)							0.051	***
							0.002	
Constant	0.175	***	0.348	***	0.338	***	0.266	***
	0.013		0.014		0.014		0.016	
Observations	249412		218117		218970		206434	
R-squared	0.010		0.023		0.020		0.014	

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors below coefficient

5. Geographical price dispersion: within-firm export price variation

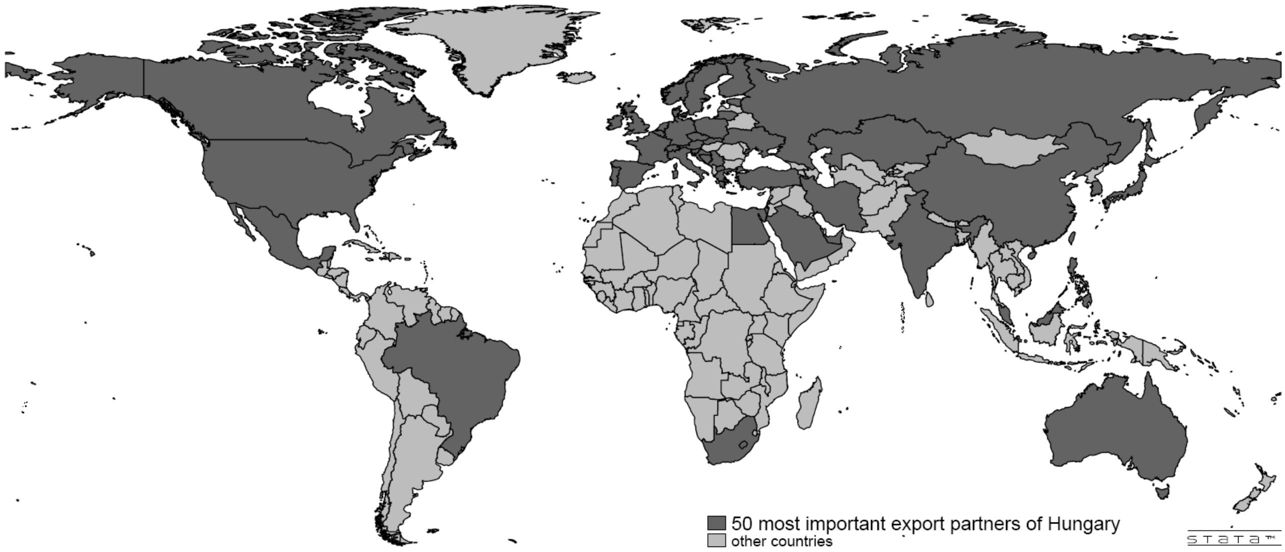
After analysing the firm-level determinants of product prices, now we focus our attention to the geographical price dispersion. Motivated by the theory surveyed in the Introduction, we focus on three questions. First, is there a geographic variation in export unit values? Second, is it mainly a result of firm-level selection, as suggested by Baldwin and Harrigan (2007), or is rather a consequence of endogeneous markups, as Ottaviano and Melitz (2008) predicts? Third, if we find variation, is in line with the prediction of the Ottaviano-Melitz approach? In particular, do prices decrease with distance, as firms absorb part of the transport cost?

Analysing these questions requires us to modify the previous approach slightly. We have to broaden the geographical coverage of the investigation as differences in distance are not too large within the European Union. That makes the identification of the relationship between distance and unit value possible. In this Section we cover Hungary’s 50 largest export markets, which are included in Table 3 and depicted in Figure 6. The map shows that the variation in distance is quite large and the relationship between distance and unit values is not identified from a few outliers exclusively.

Table 3. The 50 largest export markets of Hungary

Name	Export (M USD)	Obs.	Firms		Name	Export (M USD)	Obs.	Firms
DE	12326.4	6151	2603		SI	127.2	452	311
FR	2121.2	1365	632		IE	118.8	72	56
AT	2031.7	3121	1488		GR	117.6	152	119
IT	1776.2	1602	816		MX	104.6	32	31
GB	1638.6	778	480		CN	83.9	69	53
NL	1326.6	844	482		IL	83.5	83	61
SE	1216.1	412	285		ZA	83.0	43	37
US	1084.7	632	418		BA	82.4	217	139
ES	1002.2	287	227		NO	68.5	110	94
BE	885.7	543	335		SA	68.0	37	33
PL	720.7	776	523		HK	56.9	34	29
CZ	607.5	809	588		IN	51.8	39	31
SK	569.0	1302	812		AU	45.9	68	63
RU	482.5	488	259		LT	45.0	147	119
AE	451.7	42	36		MK	28.2	51	42
CH	422.1	786	465		BR	27.9	35	34
FI	317.1	193	136		SG	25.7	44	31
TR	255.9	141	116		KZ	24.0	31	25
DK	241.2	226	179		EG	18.0	29	26
CA	238.7	110	85		IR	15.7	29	22
PT	227.7	81	73		EE	14.7	65	56
JP	194.1	159	116		KR	13.3	33	30
HR	153.1	654	422		TW	12.2	42	31
YU	150.5	761	448		MY	9.2	23	21
UA	129.2	421	249		PH	6.1	17	12

Figure 6 The 50 most important export partners of Hungary



Gravity regressions were estimated at the firm-product-destination level for testing the previous hypotheses. Denoting firms with i, products with j and destination countries by k, we run the following regression:

$$\ln unit\_value_{ijk} = \beta_0 + \beta_1 \ln dist_k + \beta_2 \ln GDP_k + \beta_3 \ln GDP_k / population_k + \gamma X_{ij} + \varepsilon_{ijk}$$

where $dist_k$ is the geographic distance between Hungary and country k, GDP_k is the GDP of country k and X_{ij} is a set of firm-level variables potentially affecting unit values. Results are presented in Table 4. In the first two columns the whole sample is used, while in the last two columns, as a robustness check, we restrict our attention to firm-product pairs for which we have at least 6 or 9 observations. It may help identify the effect from within firm-product variation more precisely.

We estimated the coefficient of the distance at about 10 per cent for the total sample, while it is somewhat smaller for the restricted sample. The very high significance of this variable suggests that export unit values increase in distance. GDP/capita is positively related to unit values (but it is only significant for the larger sample), which is in line with the idea that higher demand prevails for higher quality products on richer markets. The effect of firm controls is similar to what was found in previous estimations.

These results suggest that unit values are systematically related to geography in general and to the gravity variables in particular. The question remains, however, whether this relationship is a consequence of selection – at the firm or at the firm-product level, as for example suggested by Baldwin and Harrigan, 2008 – or firms charge different prices for the same good on different markets, as suggested by Melitz and Ottaviano (2008)? We turn to methods using even more disaggregated data for answer.

Table 4. OLS estimates of the determinants of export unit value

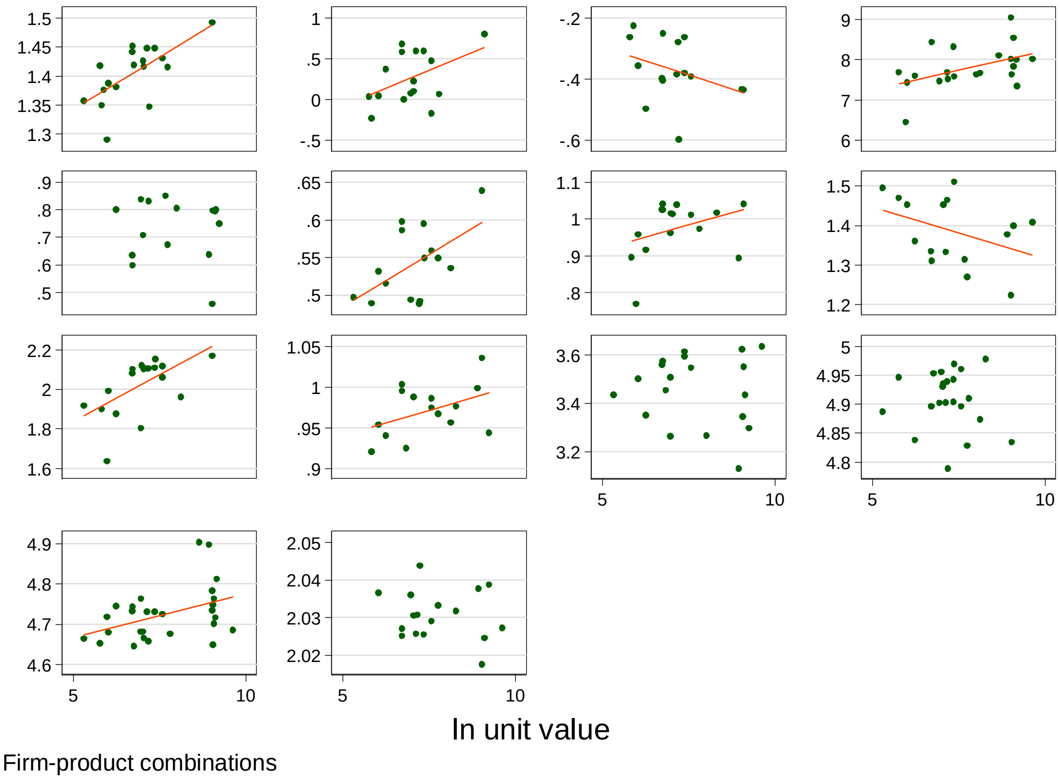
	(1)		(2)		(3)		(4)	
	whole sample		whole sample		observations for firm-product pairs > 5		observations for firm-product pairs > 8	
Log employment			-0.052	***	-0.029	***	-0.048	***
			0.004		0.010		0.013	
TFP			0.063	***	0.034	***	0.015	
			0.010		0.010		0.010	
Foreign			0.007		-0.036		-0.079	**
			0.013		0.023		0.035	
Log distance	0.101	***	0.108	***	0.074	***	0.081	***
	0.009		0.009		0.015		0.021	
Log gdp	-0.027	***	-0.025	***	-0.010		-0.006	
	0.006		0.006		0.009		0.013	
Log GDP/capita	0.044	***	0.038	***	0.026		0.043	
	0.013		0.013		0.021		0.030	
Constant	-0.542	***	-0.387	***	-0.392	**	-0.534	**
	0.108		0.111		0.184		0.267	
Observations	24166		23140		3785		1831	
R-squared	0.006		0.013		0.016		0.035	

*** p<0.01, ** p<0.05, * p<0.1

Robust standard errors below coefficients

We start by comparing unit values charged by the same firm for the same product in different countries. As an illustration, we present simple graphs showing the relationship between distance and the – conditional – normalised export unit values. A simple regression with logarithmic unit value as the dependent variable and ln GDP and ln GDP/capita as explanatory variables was estimated to capture differences in country size and wealth. The scatterplots in Figure 7 show the relationship between the predicted unit value – conditional on country size and wealth – and log distance. We also include a linear trend, if the t-value of the trend is at least 1 in a simple regression. We show the firm-product combinations for which we have the largest number of positive observations above our previously mentioned threshold, 2000 USD, and for which we can observe export outside the EU (as otherwise t-values are usually small)[7]. The Figure suggests that in half of the 14 cases one can observe a clear positive relationship. In two cases, the relationship is negative, and in a 5 cases the trend is insignificant. This Figure provides ad hoc, but quite visual evidence for the hypothesis: product unit values are systematically different across destination markets even when controlling for firm-level heterogeneity entirely and for product heterogeneity to a very high level of disaggregation. The Figure also suggests that contrary to the Melitz-Ottaviano prediction, unit values tend to be positively related to the distance between Hungary and the destination market.

Figure 7. Relationship between distance and unit values for selected product-firm pairs



Note: firm-product combinations are those with the largest number of observations and exported outside the EU. The data are from 2003

The next step after looking at the graphs is to see whether any systematic relationship between distance and unit values exists for a larger sample of firm-product pairs. Instead of concentrating only on 14 firm-product combinations, we consider all such combinations

[7] These are all firm-product combination with at least 15 observations, including at least one observation outside the EU.

which are exported to at least 7 destinations.[8] For each combination of firm i and product j, we run the following regression separately:

$$\ln unit\ value_{ijk} = \beta_{ij}^0 + \beta_{ij}^1 \ln distance_k + \beta_{ij}^2 \ln GDP_k + \beta_{ij}^3 \ln GDP/capita_k + \varepsilon_{ijk}$$

After this we receive a β_{ij}^1 for each firm-product combination. As we obtain these coefficients from directly comparing prices asked by the same firm for the same product in different markets, they purely reflect firm-product level price differences across countries; these estimates do not contain selection at the firm level or at the firm-product level. Let's have a look at the distribution of these parameters. Table 5 shows means and medians for the estimated β_{ij}^1s. They suggest that these point estimates are positive in every year and every subgroup, providing evidence for the hypothesis that firms sell the same product at more distant markets for higher unit values. Also, interestingly we see variation across years. The estimated coefficients tend to be larger in 2000, 2001 and 2002 than in 1999 and 2003.

Table 5 Estimated effect of distance on unit value for firm-product pairs with the largest number of observations

	mean	mean if exports outside EU25	mean if exports outside EU25 and |t-value|>1	median	median if exports outside EU25	median if exports outside EU25 and |t-value|>1
1999	0.024	0.046	0.080	0.016	0.034	0.115
2000	0.054	0.064	0.130	0.043	0.050	0.114
2001	0.056	0.068	0.138	0.037	0.042	0.148
2002	0.068	0.062	0.104	0.040	0.045	0.149
2002	0.032	0.055	0.121	0.014	0.011	0.084

As a final comparison of unit values one firm charges for the same product we run – firm-product – fixed effects regressions for each year restricting our attention to firms exporting to at least 10 destinations. The estimated equation is the following:

$$\ln unit\ value_{ijk} = \beta_{ij}^0 + \beta_{ij}^1 \ln distance_k + \beta_{ij}^2 \ln GDP_k + \beta_{ij}^3 \ln GDP/capita_k + \mu_{ij} + \varepsilon_{ijk}$$

where μ_{ij} is the firm-product fixed effect. Table 6 presents the results in these regressions. They are in line with the earlier descriptive results; there is a strong and highly significant positive relationship between distance and unit value within firm-product combinations. The coefficient is similar for all years, and it is between 0.05 and 0.06 which suggest about 25-30 percent price difference between Hungarian exports to Germany and to the USA. This

[8] Modifying this threshold to 5 or 10 does not change the results.

difference, which is significant both statistically and economically, suggests that selection models alone cannot account for heterogeneity in unit values. Also, it shows that the Melitz-Ottaviano prediction is not supported by the data.

Table 6. Firm-product fixed effects regressions

Year	1999		2000		2001		2002		2003	
Log distance	0.058	***	0.045	**	0.057	***	0.065	***	0.054	***
	0.017		0.017		0.013		0.013		0.016	
Log GDP	0.004		-0.006		0.002		0.007		-0.010	
	0.012		0.013		0.009		0.010		0.011	
Log GDP/capita	0.007		0.058	**	0.021		0.019		0.058	**
	0.027		0.026		0.018		0.020		0.025	
Constant	0.876	***	0.696	**	0.884	***	0.902	***	1.188	***
	0.266		0.273		0.193		0.216		0.252	
Observations	676		790		1155		1041		1091	
Firm-product	53		61		88		77		82	
R-squared	0.026		0.020		0.029		0.040		0.020	

These results can be summarised as evidence for the hypothesis that destination market characteristics play a role in the dispersion of export unit values. Unit values tend to be increasing in distance and GDP/capita and decreasing with GDP. Our results also suggest that these patterns are not due completely to the composition effects, but can be explained partly by different markups at the firm level. Interestingly, however, the relationship between distance and unit values appears to be increasing in distance what seems to contradict to the theoretical predictions of the Melitz and Ottaviano (2008) framework.

6. Conclusions

This paper studied export unit values using very detailed firm-product-destination level annual data, trying to present some stylized facts. We have detected substantial price dispersion even within highly disaggregated product categories, and the pattern of price dispersion seems to be changing in time. A decomposition exercise suggests that firm-level heterogeneity plays a more important role in explaining export price differences than country fixed effects.

Productivity, ownership and size all seem to be important determinants of export unit values, but they explain only a relatively small portion of price dispersion. More productive firms charge higher prices, which is in line with the idea that these firms produce higher quality goods. The share of the product within the export mix is also significant, providing evidence for the relevance of multi-product firm theories.

We found that gravity-type models are able to explain price variation; export unit values are higher in more distant, smaller and richer markets. These patterns are not only a consequence of firm- or firm-product level selection, but the same firm charges a different price for the same good on different markets. An important pattern in this within-firm-product variation is that firms charge higher prices on more distant markets.

References

Baldwin, Richard E. and James Harrigan (2007): *Zeros, Quality and Space: Trade Theory and Trade Evidence*, CEPR Discussion Paper No. DP6368

Békés, Gábor, Harasztosi Péter és Muraközy Balázs (2009): *Firms and Products in International Trade: Data and Patterns for Hungary*, IE-HAS Working Paper 2009/18

Bernard, Andrew, Stephen Redding, and Peter Schott (2006). *Multiproduct Firms and Trade Liberalization*, mimeo, Dartmouth.

Bernard, Andrew B., J. Bradford Jensen, Stephen J. Redding, and Peter K. Schott (2007): *Firms in International Trade*, Journal of Economic Perspectives, *21* (3), pp. 105-130.

Crozet, Matthieu, Keith Head and Thierry Mayer (2009): *Quality sorting and trade: Firm-level evidence for French wine*, CEPR Discussion Papers No. 7295

Hallak, J. C., and J. Sivadasan (2006): *Productivity, Quality and Exporting Behavior under Minimum Quality Requirements*, Unpublished, University of Michigan available at http://economics.stanford.edu/files/HallakjDec3.pdf

Johnson, Robert C. (2007): *Trade Prices with Heterogeneous firms*, Unpublished working paper, Berkeley, available at http://www.crei.cat/news/recpapers08/johnson.pdf

Kneller, Richard and Zhihong Yu (2008): *Quality Selection, Chinese Exports and Theories of Heterogeneous Firm Trade*, University of Nottingham mimeo. Available at: http://www.etsg.org/ETSG2008/Papers/Kneller.pdf

Levinsohn, James and Amil Petrin (2003): *Estimating Production Functions Using Inputs to Control for Unobservables*, Review of Economic Studies, 70(2), pp. 317-342.

Melitz, Mark J. (2003): *The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity*, Econometrica, Vol. 71, No. 6 (Nov., 2003), pp. 1695-1725

Muraközy. Balázs and Gábor Békés (2009): *Temporary Trade*, IE-HAS discussion paper, 2009/9, available at: http://econ.core.hu/file/download/mtdp/MTDP0909.pdf

Manova, Kalina B. and Zhiwei Zhang (2009): *Export Prices and Heterogeneous Firm Models*, mimeo, available at SSRN: http://ssrn.com/abstract=1326712

Mayer, P. T. and G. I. Ottaviano (2007): *The Happy few. The internationalisation of European firms, European Firms and International Markets (EFIM),* Bruegel Blueprint Series.

Melitz, Marc and Gianmarco Ottaviano (2008): *Market size, Trade and Productivity*, Review of Economic Studies 75, no. 1: 295-316.

Rauch, J. (1999): *Networks versus markets in international trade*., Journal of International Economics **48**, 7-35.