Quality Upgrades of EU Agri-food Exports

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Abstract

We investigate determinants of quality upgrades in EU agri-food exports using panel data models for the period 2000–2011. By employing highly disaggregated data we show that the unit value of exports is positively correlated to level of economic development and size of population. Our results highlight the negative impacts of comparative advantage and trade costs on upgrades in export quality. Our analysis partly confirms the role of income distribution in quality specialisation, that greater income inequality increases specialisation in quality upgrades. Findings are robust when applied to alternative subsamples, including vertically specialised and final agri-food products.

Keywords: *Export quality; income inequality; vertical comparative advantage; agri-food exports; European Union.*

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1. Introduction

Empirical research into growth in international trade has shown that accounting for specialisation *across* goods and specialisation *within* goods along the quality dimension is important (Schott, 2004). Although the existing literature on international trade tends to focus on either one or the other of these factors, the two are likely to be connected. The role of quality in international trade has been recognised through the use of models applied to vertical intra-industry trade (IIT) by Falvey and Kierzkowski (1987) and Flam and Helpman (1987). A body of empirical studies has clearly documented the increasing importance of vertical IIT in international trade (e.g. Fontagné *et al.*, 2006; Jensen and Lüthje, 2009). During the last decade the relevance of product quality in international trade has also been recognised in the non-IIT literature. There also exists a growing literature about the drivers of a country's vertical comparative advantage (i.e. comparative advantage in terms of quality). Differences across countries in terms of technology and/or a relative abundance of other factors have been offered as explanation (e.g. Schott, 2004; Verhoogen, 2008; Fieler, 2011). Feenstra and Romalis (2014) provide a supply side explanation based on a firm heterogeneity model of the patterns of trade and product quality. On one hand, models of endogenous quality choice by firms give rise to an Alchian and Allen (1964) effect: goods of higher quality are shipped longer distances (Hummels and Skiba, 2004). On the other hand, quality depends on the fixed costs of exporting. As foreign demand rises, an increase in relative exports encourages less efficient firms to enter and export to that market, and average quality falls. In addition, Fajgelbaum *et al.* (2011) have identified the conditions under which a richer (or more unequal) economically developed country makes greater demands for high quality goods. These authors provide a demand-based explanation for patterns of international trade in goods of different levels of quality.

Patterns of European Union (EU) agri-food trade specialisation have been explored in depth (Bojnec and Fertő, 2008, 2009, 2015). Similarly, the increasingly important role of vertical IIT in EU countries has already been recognised (e.g. Fertő, 2005; Jámbor, 2014; Fertő and Jámbor, 2015). Moreover, the quality content of EU agri-food trade has been analysed by Curzi and Olper (2012), Curzi *et al.* (2013, 2015) and Olper *et al.* (2014).

Here, we investigate the quality dimension for EU agri-food exports as the relationship between specialisation across goods and specialisation within goods. We examine econometrically the link between increases in export quality and comparative advantage, where the quality of agri-food exports is explained using the exporting country's characteristics: level of economic development, income distribution, and comparative advantage. More specifically, we investigate the quality content of the agri-food exports to the global market from the EU-27 Member States (which are heterogeneous both in terms of level of economic development and income inequality).

The rest of the paper is structured as follows: section 2 provides a review of former research and the development of hypotheses. Section 3 explains our data and database construction. Empirical results are presented in section 4. Section 5 concludes.

2. Previous Research and the Development of Hypotheses

Hummels and Klenow (2005) and Hallak (2006) show that export unit prices (as a proxy for quality) increase with exporter and importer income per capita, and suggest that countries with higher income per capita produce and consume products of higher quality.

Similar evidence for increases in export unit prices is found at the firm level (see Bastos and Silva, 2010; Manova and Zhang, 2012), and through using a structural approach, such as that applied by Khandelwal (2010) and Hallak and Schott (2011). In addition, a greater preference for quality in richer countries can be explained by the fixed costs of exporting and their offsetting for marginal cost effects such as higher wages for higher export prices with respect to the quantity of inputs in the supply-side structure of heterogeneous firms (Feenstra and Romalis, 2014). On this basis of these findings, we propose the following hypothesis (H1):

H1: Richer countries tend to export higher quality products.

Income distribution has also been accepted as an important driver of trade patterns, especially for importers. The role of income inequality on different patterns of demand was recognised in the early IIT literature (e.g. Falvey and Kierzkowski, 1987; Flam and Helpman, 1987) which suggested that different drivers of demand affect vertical trade patterns, and recognised the existence of a vertical home market effect (Linder, 1961; Fajgelbaum *et al.*, 2011). Francois and Kaplan (1996) and Dalgin *et al*. (2008) examine the effect of income inequality on the type of goods imported. They find that a higher income inequality leads to more demand for differentiated goods and for luxury goods. Choi *et al*. (2009) examine the correlation between income distribution of the importing country and the distribution of import prices, applying the theoretical model of Flam and Helpman (1987). Their results show that the differences in import price distributions are correlated with differences in their income distributions. However, Bekkers *et al*. (2012) find that unit values of trade decline in income inequality of the importing country.

However, the relationship between a country's income distribution and the quality of its exports is rather ambiguous, although Latzer and Mayneris (2014) show that the positive effect of income inequality on export unit prices is sizeable only if coupled with an increase of average income. Based on these theoretical and empirical results, we derive the following hypothesis (H2):

> *H2: Income inequality is positively correlated with the export quality only in rich countries.*

Following Bernard *et al.* (2007), we predict that greater comparative advantage translates into greater efficiency and lower export unit prices. Latzer and Mayneris (2011, 2014) confirm this prediction, finding a negative correlation between export unit prices and comparative advantage. Accordingly, the following hypothesis (H3) is derived:

H3: Export prices are negatively associated with comparative advantage.

In addition, we control for two common factors. First, we introduce trade costs. Recent analyses have revealed that there are empirical regularities in the relationship between the quality of exported goods and the trade costs that are sensitive to geographic distance to the country of destination. More specifically, they show that unit values of exported goods increase with distance to the trading partner, with distance acting as a proxy for per unit trade costs. This evidence of a positive relationship between export prices and distance is robust both at the product and firm level (Bastos and Silva, 2010; Baldwin and Harrigan, 2011; Manova and Zhang, 2012; Martin, 2012; Feenstra and Romalis, 2014). This fact can be explained in two ways. On one hand, this suggests that firms improve the quality of the goods they export to more distant markets. On the other hand, fixed per unit trade costs can induce a positive relationship between distance and product quality (the Alchian and Allen (1964) effect). Because the relative prices of high-quality, high-price goods are lower in distant markets when there are fixed trade costs, there is a stronger relative demand for high-quality goods in these markets.

Second, we use size of population as a proxy for market size, though doing so introduces theoretical and empirical ambiguities. Fajgelbaum *et al.* (2011) suggest that growth in population disproportionately increases the number of varieties that are horizontally differentiated. Because it is reasonable to assume that high-quality products are more differentiated than low-quality, a positive association between unit export prices and population size is indicated. Most papers that use firm-level data find a positive effect for market size on the unit prices of exported goods (Bastos and Silva, 2010; Manova and Zhang, 2012). However, Desmet and Parente (2010) have shown that larger markets exhibit lower mark-ups, and, consequently, favour larger firms; a fact which promotes process innovation and implies the existence of a greater number of lower-priced products in larger countries. Empirical research that has employed aggregate data using unit values has identified the negative impact of market size on export prices (Hummels and Lugovskyy, 2009; Baldwin and Harrigan, 2011; Bekkers *et al.*, 2012).

3. Data and Database Construction

3.1. Unit value (UV) of exports as a dependent variable

In testing hypotheses H1 to H3, the crucial question is how to measure export quality as a dependent variable. There are many potential approaches to establishing a proxy for product quality in trade analysis, each with advantages and limitations, although a consensus has not been reached about the exact definition of quality. The unit value of exports has traditionally been used as a proxy for quality in the trade-related empirical literature (Aiginger, 1997; Schott, 2004; Hummels and Klenow, 2005; Hallak, 2006; Bojnec and Fertő, 2008, 2009; Bekkers *et al.*, 2012). Unit values are easy to calculate for a given product category (as defined using the 6-digit level of the World Customs Organization's Harmonized Commodity System, HS-6).

Our empirical analysis of the unit values of exports of agri-food products is conducted using detailed trade data at the six-digit HS-6 level. Annual agri-food exports (as defined by the World Trade Organization) consist of 789 product groups at the HS six-digit level. The UN Comtrade database (UNSD, 2013), with the World Integrated Trade Solution (WITS) database and software (denominated in US dollars) for value and quantity of exports (World Bank, 2013) is used to determine the unit values of exports, as the ratio of export value to export quantity. Because unit values can be noisy, we employ the following screening procedures proposed by Choi *et al.* (2009) and Feenstra and Romalis (2014). First, we use pooled data for years 2000–2011. Second, the data on agri-food exports were cleaned so as to include only export flows of a minimum shipping weight of one kilogram. In addition, export flows were excluded if they were less than 0.1 times or higher than 10 times the median unit value of exports observed for that commodity within the EU-27 Member States. This data cleaning procedure eliminates only 1% of our observations. Our data sample includes all EU-27 Member States for the period between 2000 and 2011.

3.2. Explanatory variables

Data for the explanatory variables are obtained from the following data sources: GDP per capita and population from the World Bank (2014b) database, and Gini indices from the UNU-WIDER (2014) database. The World Bank (2014a) Trade Costs Dataset provides estimates of bilateral trade costs in agriculture and manufactured goods for the 1995–2012 period, using trade and production data collected in 178 countries. Symmetric bilateral trade costs are computed using the Inverse Gravity Framework (Novy, 2012), which estimates trade costs for each country pair using bilateral trade and gross national output. For our purpose, agri-food specific trade costs are calculated as average agricultural bilateral trade costs for each of the EU-27 Member States as a simple arithmetic mean of all bilateral trade costs. Note that we calculated average agricultural bilateral trade costs for each year separately, thus they are varying over time in contrast to traditional time invariant trade costs variables including for distance between capitals, and proximity variable for common language or contingency.

Our revealed comparative advantage (RCA) index is calculated in the same way as the Balassa (1965) index. However, due to the skewed distribution of the RCA index we employ its symmetrical version (SRCA=(1–RCA)/(1+RCA)) (Dalum *et al.*, 1998) on the basis of the World Bank (2013) database.

3.3. Model specification

We use the natural logarithm (ln) of unit value of exports (UV) as a dependent variable. The general form for the models is the following:

$$\ln UV_{ijpt} = \alpha + \beta_1 \ln GDPcapita_{it} + \beta_2 \ln Gini_{it} + \beta_3 SRCA_{ipt} + \beta_4 \ln Tradecost_{it} + \beta_5 \ln Population_{it} + \beta_6 Rich_{it} * \ln Gini_{jt} + \gamma_{ipt} + \varepsilon_{ijt}, \quad (1)$$

where *i* refers to the exporting country, *j* the importing country, p is the product, *t* is the time period (years), *Rich* is a dummy variable which has a value of one for a country with a level of economic development (GDP per capita) greater than 16,000 US dollars, and zero otherwise. Except for the *SRCA* index and *Rich* dummy variables, other explanatory variables are expressed in *ln* form. We specify exporter/product/time fixed effects (γ_{ipt}) to control for the unobservable heterogeneity on the exporter side. ε_{ijt} is the error term. In this model, at the agri-food product level, the quality content of exports of a country is determined by the size of the market for the high quality within this country. Therefore, exports are driven by exporter specialisation (and implied access capacity). The three variables influence the size of the market for the high product quality of exports: GDP per capita, size of population and income inequality. We introduce these three variables separately to identify the different channels of upgrading of agri-food quality of exports.

Finally, our dependent variable is exporter-importer-product-year specific, while explanatory variables of interest are exporter-year specific, except for the SRCA index. Thus, standard errors of the coefficients on exporter-year characteristics might consequently be downward biased. To correct for this, we cluster all the regressions at the exporter-year level that is at the level of aggregation of our variable of interest.

4. Results

The regression models are based on a large data sample of 147,152 observations. In addition, we construct three subsamples. Following Latzer and Mayneris (2011, 2014), we use the following method to construct an indicator of the unit value of exports for vertical specialisation: first, we rank agri-food products according to the coefficient of variation of their UV of exports within the EU-27 Member States. Second, we define the top 50% of products in terms of observed UV of export dispersion as vertically specialised goods.

We employ the United Nations Broad Economic Categories (UN BEC) classification scheme to define final goods for agri-food products. Our subsample for final goods includes goods under code BEC 112 – primary products mainly for household consumption, and BEC 122 – processed products mainly for household consumption. Finally, we drop observations with values of exports smaller than US$ 10. With this imposed assumption we aim to test whether the larger export size above the set minimum increases agri-food quality upgrades. The former two sub-samples are created to investigate possible sensitivity and robustness of the results related to the agri-food product differentiation and the final sub-sample according to the minimum product trade size.

Table 1 displays our results. Our sub-samples with a restricted number of observations – for vertically differentiated agri-food products in column (5), for final (consumption) agri-food products in column (6), and for exports of agri-food products worth more than US$ 10,000 in column (7) – are based on large datasets with 73,403, 85,559 and 127,248 observations, respectively.

We first provide evidence based on OLS regressions with exporter-product-year fixed effects. According to H1, our results show that UV of exports and GDP per capita are positively correlated for all specifications, with coefficients ranging between 1.5 and 1.72, which are significant at the 1% level. Our estimates confirm findings by earlier research (Schott, 2004; Hummels and Klenow, 2005; Latzer and Mayneris, 2011, 2014). This is evidence of a supply-side based determinant of increases in agri-food export quality.

More specifically, it is evident that average GDP per capita must reach a high enough level to have a sizeable positive effect on the development, production and export of high-quality agri-food varieties.

The income inequality, which is measured with Gini indices, positively and significantly influences the UV of exports for all models. However, our main interest is the interaction variable between rich countries and income inequality in the exporting country (according to equation (1)). The regression coefficients of the interaction term are positive and weakly significant for the model in columns (4) and (7) partly confirming H2 that income inequality in rich countries is a significant driver of increases in UV of exports.

In columns (2) to (7), we control the UV of export regression for the symmetric Balassa index of revealed comparative advantage. This SRCA variable is affected by a negative and significant coefficient confirming H3: countries that are relatively more specialised in a given product exhibit lower UV of exports for that product, indicating a cost advantage for these product-exporter pairs. This finding is consistent with the research outcomes of Bernard *et al.* (2007) and Latzer and Mayneris (2011, 2014) which suggest that a greater comparative advantage translates into higher efficiency and price competitiveness with lower export UV.

Among the controlling explanatory variables, and contrary to the findings of earlier studies (e.g. Bastos and Silva, 2010; Baldwin and Harrigan, 2011; Manova and Zhang, 2012; Martin, 2012; Feenstra and Romalis, 2014), our models indicate that UV of exports is significantly negatively associated with trade costs. As export prices and export volumes are positively correlated, the negative relationship between export quality and trade costs is in line with the gravity model. This result can be explained by the geographical location of the EU-27 Member States: most agri-food products are traded internationally at higher UV between developed clusters of old core EU Member States over short distances with lower transportation costs.

The UV of exports is significantly positively associated with *Population* for all specifications. This finding is consistent with research of Fajgelbaum *et al.* (2011) who found that growth in market size or population increases disproportionately the number of horizontally differentiated varieties (which tend to be of higher quality). Our results are also in line with firm-level analysis showing a positive relationship between market size and export prices (Bastos and Silva, 2010; Manova and Zhang, 2012).

Table 1

Average unit value (UV) of export and exporter characteristics

	Dependent variable: $\ln UV_{ijt}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
					Vertically differentiated products	Final goods	Export>10,000 US dollars
ln*GDPcapita*	1.57***	1.59***	1.64***	1.63***	1.50***	1.72***	1.63***
ln*Gini*	0.39***	0.40***	0.20***	0.18***	0.18***	0.16***	0.18***
SRCA		–0.14***	–0.15***	–0.15***	–0.23***	–0.09***	–0.15***
ln*Tradecosts*			–0.49***	–0.49***	–0.40***	–0.41***	–0.49***
ln*Population*			2.59***	2.58***	2.19***	2.76***	2.58***
*Rich**ln*Gini*				0.01*	0.01	0.01	0.01*
Constant	–21.48***	–21.79***	–56.86***	–56.65***	–61.17***	–60.91***	–69.15***
R-squared	0.503	0.508	0.518	0.518	0.407	0.566	0.518
N	147,152	147,152	147,152	147,152	73,403	85,559	127,248

Source: Authors' own calculations.

Note: * p<0.1; ** p<0.05; *** p<0.01. All regressions include exporter/product/time fixed effects.

Our specifications based on equation (1) so far measure a ‘discrete’ heterogeneity in the impact of income inequalities. They allow for a different coefficient on the income inequality index for rich and poor countries, both categories being defined according to a pre-determined income threshold. However, it might be the case that the change in the impact of income inequalities along average income is continuous, and not dichotomous. In Table 2, we investigate such a continuous heterogeneity by interacting directly ln GDP per capita and the ln Gini index.

Table 2

Average UV of exports and exporter characteristics with continuous heterogeneity

	Base	Vertical	Final goods	Export>10,000 US$
ln*GDPcapita*	1.40***	1.19***	1.60***	1.49***
ln*Gini*	–0.14	–0.17	–0.02	–0.28
SRCA	–0.14***	–0.21***	–0.09***	–0.08***
ln*Tradecost*	–0.45***	–0.32***	–0.41***	–0.49***
ln*Population*	2.42***	1.93***	2.70***	2.49***
ln*Gini**ln*GDPcapita*	0.03	0.03	0.02	0.047
Constant	–52.35***	–53.55***	–71.38***	–66.11***
Observations	147,548	73,35	85,598	126,709
R-squared	0.544	0.440	0.578	0.576

Source: Authors’ own calculations.

Note: * p<0.1; ** p<0.05; *** p<0.01, All regressions include exporter/product/time fixed effects.

Our results are qualitatively rather similar. We have the same signs and significance for GDP per capita, SRCA, population and trade costs. Our estimates reinforce both H1 and H3. However income distribution variables show different results. The coefficients of income inequality variables and interactions are not similar. In other words, income distributions do not matter for the unit value of exports.

5. Conclusion

Our research clearly supports the following statements about the determinants of quality of EU agri-food exports: the unit values of exports are positively associated with economic development and size of population of the exporter, and are negatively associated with SRCA and trade costs. These empirical findings remain robust when applied to alternative data sub-samples, including those compiled for vertically specialised and final agri-food products. Income distribution and income inequalities play either a small or no role in quality specialisation as reflected in unit values.

These empirical findings have relevance for agri-food export-related research and practice. To the authors' knowledge, this is the first investigation into quality of agri-food exports in general, and is unique in that it applies panel data models to the EU-27 Member States.

Product quality on the global and bilateral agri-food markets is driven by export and import forces. Our approach focuses on the exporting country (supplying) characteristics, but not on the demand-side for quality exports by the importer, where a crucial role can be played by international value chains, and particularly by consumers' willingness to pay for foreign agri-food products on domestic markets. These are issues for further global agri-food international trade and agri-food international business and marketing research, which play an important role in international agri-food value chains. On the supply-side, achieving higher unit values for exports requires investment into research, development and innovation activities, in addition to having favourable factor endowments. The level of economic development (income per capita, or the purchasing power of the population), and market size appear to be important. The direction of causality between supply-side factors in export quality specialisation and demand-side factors that relate to the quality of imports – along with the role of incomes and income inequalities – are issues for further research.

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