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Do Food Standards Affect the Quality of EU Imports ?

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Abstract. This paper investigates the relationship between the diffusion of EU standards and product quality upgrading using highly disaggregated import data to the EU in the food industry. Results show that, on average, the diffusion of EU voluntary standards boosts the rate of quality upgrading. However the results are heterogeneous when moving from primary to processed foods, and from ISO to non-ISO standards.

Keywords: Quality Upgrading, EU Food Standards, Competition, Distance to the frontier.

JEL classification: C23, F13, F14, L15, O14, Q17

1. Introduction

Food standards increasingly govern international food supply chains. One of the most studied issue is about their trade effects. Standards could either act as non-tariff barriers to trade – lowering countries’ exports – or as catalysts to trade – leading to export gains, by modernizing the food supply chains through innovation and products upgrading (Swinnen, 2007). Studies focusing on public standards, such as sanitary and phytosanitary measures (SPS), more often find that they act as non-tariff barriers to trade (see Li and Beghin, 2012, for a recent survey). On the other hand, studies based on private and, especially, voluntary standards often find a positive effect of standards on the intensity of trade flows, at least when harmonized standards and North-North trade are considered. However, there are several exceptions (see Blind and Jungmittag, 2005; Swann, 2010; Shepherd and Wilson, 2013).

Empirically, the trade effect of food standards has been largely studied within the gravity model framework. However, until now less attention has been paid to the direct quantification of the relationship between the diffusion of standards and the rate of firms’ exports quality

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upgrading. This is quite surprising, especially because the upgrade of traded products is at the heart of the standards as a catalysts to trade hypothesis (Maertens and Swinnen, 2009; Henson et al. 2011).

In this paper, we provide the first broad formal evidence that the diffusion of (voluntary) standards in the export destination market systematically affects the rate of quality upgrading of the imported food products.

To this end, we use highly disaggregated data on exports to the European Union (EU) from about 70 countries in more than 2,000 food products. Product quality is inferred from trade data, using a recent approach developed by Khandelwal (2010). Our empirical exercise is carried out within the ‘distance to the frontier’ model of Aghion et al. (2005). In this framework, the effect of standards on quality upgrading should depend on the pro- or anti-competitive effect of standards. Because the effect of standards on trade and competition which emerges from the literature is ambiguous, this relationship is an empirical question.

2. Conceptual framework and the empirical model

According to the distance to the frontier framework of Aghion et al. (2005), an increase in competition induces firms (sectors) that are initially close to the technology frontier to innovate more, while it reduces the expected rents from innovation for firms (sectors) further away from the technology frontier. The interplay between these two forces induces a relationship between competition and innovation that is non-monotonic and conditional to the firm/industry distance from the technology frontier.

According to this line of research, anticompetitive regulations influence the productivity of existing firms/industries by curbing the incentives to adopt the leading technologies available in the market and innovate. Starting from this consideration, our aim is to study the relationship between quality upgrading, as a key form of innovation, and the diffusion of food standards, as a form of market regulations. This relation should be linked to how food standards affect the competitive environment. At least two main hypotheses can be formulated (Blind and Jungmittag, 2005).

First, as discussed in Leland (1979), Hudson and Jones (2003) and many others, standards can serve as an important quality signal in trade and thus help to promote the competitiveness of those that meet stringent standards. Evidence that food standards can stimulate competitiveness can be found in Maertens and Swinnen (2009) and Henson et al. (2011). Moreover, standards can help to overcome the ‘lemons’ problem, where incomplete and asymmetric information on the quality of products lead to a market failure and a

reduction in average product quality (Leland 1979). Under this hypothesis, the distance to the frontier model should predict that the diffusion of standards boosts quality upgrading in the leading firms/sectors, but hinders it in laggard firms/sectors.

However, standards may also have negative effects, raising barriers to entry especially by increasing compliance costs. Indeed, while in principle standards can be considered as a public good because they can be used by every producer, in practice, due to their high adaptation costs, outsiders with no influence on the standardization process may face considerable disadvantages when complying with standards (Blind and Jungmittag, 2006; Swann, 2010). Moreover, a peculiarity of many food standards is that they are often driven by the preferences of consumers, as for the case of GMOs standards (Vigani et al., 2012). More in general, the anti-competitive effects of standards may derive, intentionally or unintentionally, from the national political process (Fisher and Serra, 2000; Swinnen and Vandemoortele, 2011). To the extent to which standards are protectionist, the distance to the frontier model predicts a negative relation between their diffusion and the rate of quality upgrading, particularly for firms and products that are close to the quality frontier.

Empirically, the concurrent hypotheses summarized above can be tested following Amiti and Khandelwal (2013). Let DF_{cht} be the distance to the frontier of variety ch (product h exported by country c), at time t , namely the ratio of its quality to the highest quality within the same product category (CN 8-digit).¹ Our strategy is aimed to test the following empirical model:

$$\Delta \ln \lambda_{cht}^F = \beta_1 DF_{cht-5} + \beta_2 STD_{ht-5}^{eu} + \beta_3 (DF_{cht-5} * STD_{ht-5}^{eu}) + \gamma_i X_{cht-5} + \varepsilon_{cht} \quad (1)$$

The dependent variable, $\Delta \ln \lambda_{cht}^F$, is the change in a variety's quality between period t and $t - 5$. All the explanatory variables are lagged of five years. Quality growth is explained by the lagged proximity to the frontier (DF_{cht-5}), the (log) lagged number of EU standards (STD_{ht-5}^{eu}) and the interaction term between these two variables ($DF_{cht-5} * STD_{ht-5}^{eu}$). This interaction term should allow for the possible non-monotonic relationship stressed by the distance to the frontier model. Finally, X_{cht-5} is a vector of other potential controls. The error term, $\varepsilon_{cht} = \alpha_h + \alpha_{ct} + \sigma_{cht}$, includes both product (α_h) and country-year (α_{ct}) fixed effects, plus an identically distributed idiosyncratic error (σ_{cht}).²

¹ Note that, for varieties close to the frontier DF_{cht} will be close to 1, while for varieties far to the frontier DF_{cht} will be close to 0.

² Since quality is estimated using a nested logit demand function *separately* within each 4 digits product/industry (see section 3), the product fixed effects ensure that the estimation only exploits the variation between comparable quality estimates. The country-year fixed effects sweep out country-level shocks that affect

3. Quality estimate and the data

To estimate quality we replicate the procedure in Khandelwal (2010) on the EU markets, based on the following equation:

$$\ln(s_{cht}) - \ln(s_{0t}) = \lambda_{1,ch} + \lambda_{2,t} + \alpha p_{cht} + \sigma \ln(ns_{cht}) + \lambda_{3,cht}, \quad (2)$$

where s_{cht} is the market share of variety ch in year t , and s_{0t} is the market share of the domestic production. On the right-hand side, $\lambda_{1,ch}$ is the variety ch fixed effect, $\lambda_{2,t}$ is the time effect, and $\lambda_{3,cht}$ is the residual. Other right-hand side variables are the price of the variety ch , p_{cht} , and the (nest) share of variety ch in total imports for the CN-8 category h , ns_{cht} .

We estimate equation (2) separately for each NACE 4-digit industries in all the considered importing countries (the EU-15 members). The estimation is carried out by using 2SLS, to account for the potential correlation of the error term, $\lambda_{3,cht}$, with both the variety's price and the nest share. Following Khandelwal (2010) and Colantone and Crinò (2011), price is instrumented by the interaction between unit transportation costs and the distance from c and the interaction between the oil price and the distance from c ; differently the nest share is instrumented by the number of varieties exported and the number of varieties exported by each trading partner to the EU.

The quality of variety ch at time t , $\hat{\lambda}_{cht}$, is then obtained by:

$$\hat{\lambda}_{cht} = \hat{\lambda}_{1,ch} + \hat{\lambda}_{2,t} + \hat{\lambda}_{3,cht}. \quad (3)$$

When implementing this procedure we follow closely Khandelwal (2010) and Colantone and Crinò (2011), which may be consulted for further details. Differently, for a description and discussion of the quality estimates and details of the data used, see Curzi et al. (2013).

We collect data on European standards from the *European Union Standard Database* (EUSDB). EUSDB provides data on voluntary standards in force in the European Union from 1995 to 2003. Data are mapped according to the standard trade HS 4-digit classification. EUSDB includes only standards at the Community level, hence excluding national standards set by individual Member States. The EUSDB database also provides information on whether or not a particular EU standard implements a corresponding international harmonized, ISO, standard (see Shepherd 2007 for further details).

competition such as technological shocks, changes in relative endowment, changes in institutions that affect competition.

In order to control for the level of competition that the exporters face in their own country and industry, we use as additional control *ad valorem* tariffs data for all the exporting countries in our sample. We collect these data from WITS, at the HS 6-digit level and over time.

4. Results

Table 1 reports our baseline results about the effect of standards on quality upgrading. In column 1, the negative coefficient of the lagged proximity to the frontier suggests that varieties far from the frontier, on average, display a faster rate of quality upgrading. More importantly, the estimated coefficient of standards is positive and strongly significant for the linear term, and negative but insignificant for the interaction with the distance to the frontier variable. Column 2 adds to the specification the exporters level of tariff and its interaction with the distance to the frontier. A positive coefficient on the linear tariff and a negative coefficient on the interaction term imply that varieties close to the world frontier are more likely to upgrade quality in response to an increase of competition (tariffs reduction), while the opposite holds for varieties far from the frontier. The last result is in line with that of Amiti and Khandelwal (2013) and supports the distance to the frontier framework. However, more importantly for our purpose, controlling for tariffs the effect of standards on quality upgrading is virtually unaffected.

Quantitatively, the magnitude of the economic effect is quite important. A 10% increase in the number of standards, on average, induces an increase in the rate of quality upgrading of about 1.6%, an effect that marginally decreases to 1.5% for varieties close to the frontier.

Next, an interesting question is whether the results discussed above are heterogeneous across different types of products. Indeed, some evidence from the literature suggests that the negative trade effects of food standards could be more severe for primary than for processed food products (Shepherd and Wilson, 2013; Li and Beghin, 2012). This is indeed what we find from our data. First, considering primary products (column 3) the effect of standards turns out to be significantly negative, and more so for varieties close to the frontier. On the other hand, considering processed food (column 4) the effect is positive and stronger in magnitude with respect to the whole sample. This appears in line with the idea that processed foods are more differentiable than primary ones. Although the results on the whole sample

hide this differentiated effect of standards, it is clear that these results are driven by processed products which represent about 86% of the observations in our sample.³

A second issue raised in the literature suggests that the effect of standards could be heterogeneous when considering ISO vs. non-ISO standards, as well as the level of countries' development (Blind and Jungmittag, 2005; Czubala et al. 2009; Shepherd and Wilson, 2013). In Table 2 we study these hypotheses in depth. When comparing ISO and non-ISO standards the effect on the rate of quality upgrading is opposite, namely significantly negative for ISO standards (and increasing when approaching to the frontier) and positive and significant for non-ISO standards (not affected by the distance to the frontier). Note moreover that the (absolute) magnitude of the economic effect for non-ISO standards is more than three times higher. Moreover, splitting these effects according to the different level of development (OECDs vs. non-OECDs), the main results hold except for the ISO standards effect on developing countries, which is still negative but lower in magnitude and not significant.⁴

The different effect that emerges between ISO and non-ISO standards on quality upgrading, at first glance may appear counterintuitive. However, since our product quality measure is implicitly driven by the market share in the destination country, after controlling for price (see Section 3), these results come as no surprise. In fact, one should consider that complying with the EU non-ISO standards could represent a valuable strategy to increase the market share in such a demanding market. Differently, the negative effect of ISO standards, even if small in magnitude, makes sense if one considers their characteristics. First, as the result of an international harmonization process, ISO-standards tend to be less demanding in term of compliance requirements. Second, they can lead to a reduction of product diversity, and thus slow down the incentives for intra-industry trade (Blind and Jungmittag, 2005). The finding that ISO standards affect negatively the quality upgrading for trade coming from OECDs, but not for non-OECDs, gives credence to this interpretation.

5. Conclusions

In this paper we provide evidence that the effect of the diffusion of EU food standards on the rate of quality upgrading is, on average, positive and largely driven by non-ISO standards and processed food. At the same time we showed that the effect of food standards, unlike that

³ All the results in Table 1 hold and are robust even when splitting the sample in OECD and non-OECD countries. These additional results are available upon request.

⁴ The results presented above are robust to the following robustness checks: different definitions of the quality frontier; controlling for the (EU-15) import tariffs; different combinations of product, country and year dummies; heterogeneity effect according to institutional variables. This additional results are available from the authors upon request.

of tariffs, does not appear conditional to the variety distance from the quality frontier. Thus, from this perspective, our results confirm the mixed effects of standards on competition.

However, we want to stress that the *average* positive effect of EU standards on exports quality upgrading of both developed and developing countries is a new finding, in sharp contrast with much of the gravity literature that often highlighted the barrier to trade effect of standards. Clearly, these two results are not strictly comparable, because they focus on two different concepts, namely quality upgrading in trade vs. trade flows *per se*. However, to the extent to which the quality of exported products matters for the firms' export performance, as a large and growing literature suggests, these findings may have interesting trade and welfare implications.

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Table 1. Quality, competition and standards: baseline results

	<i>All products</i>		<i>Primary</i>	<i>Processed</i>
	(1)	(2)	(3)	(4)
Lagged distance to the frontier ($t - 5$)	-0.503*** (0.037)	-0.458*** (0.042)	-0.394*** (0.059)	-0.470*** (0.046)
Lagged ln standard ($t - 5$)	0.158*** (0.032)	0.158*** (0.032)	-0.188*** (0.046)	0.198*** (0.039)
Lagged ln standard * distance to the frontier ($t - 5$)	-0.0090 (0.006)	-0.010* (0.006)	-0.040* (0.022)	-0.005 (0.005)
Lagged tariffs ($t - 5$)		0.077** (0.029)	0.141** (0.067)	0.067** (0.028)
Lagged tariffs * distance to the frontier ($t - 5$)		-0.183*** (0.047)	-0.342*** (0.111)	-0.173*** (0.052)
Importer-Product fixed effects	YES	YES	YES	YES
Exporter-Year fixed effects	YES	YES	YES	YES
Observations	226485	226485	31072	195413
R-sq	0.230	0.230	0.230	0.232

Notes: Primary and processed products are classified according to the BEC classification; Standard errors are clustered by exporting country (with EU countries treated as one country because of its common trade policy). Significance * .10 ** .05 *** .01.

Table 2. Quality, competition and standards: ISO vs. non-ISO standards

	<i>All countries</i>	<i>OECDs</i>	<i>Non-OECDs</i>
	(1)	(2)	(3)
Lagged distance to the frontier ($t - 5$)	-0.472*** (0.048)	-0.483*** (0.048)	-0.380*** (0.113)
Lagged ln ISO standard ($t - 5$)	-0.055*** (0.011)	-0.059*** (0.012)	-0.039 (0.029)
Lagged ln ISO standard * distance to the frontier ($t - 5$)	-0.028** (0.012)	-0.027* (0.014)	-0.032 (0.037)
Lagged ln non-ISO standard ($t - 5$)	0.183*** (0.029)	0.185*** (0.031)	0.180*** (0.032)
Lagged ln non-ISO standard * distance to the frontier ($t - 5$)	-0.002 (0.008)	-0.005 (0.009)	0.008 (0.031)
Lagged tariffs ($t - 5$)	0.055 (0.033)	0.032 (0.028)	0.139** (0.056)
Lagged tariffs * distance to the frontier ($t - 5$)	-0.178*** (0.051)	-0.158*** (0.047)	-0.226* (0.129)
Importer-Product fixed effects	YES		YES
Exporter-Year fixed effects	YES		YES
Observations	226485		226485
R-sq	0.230		0.230

Notes: Columns 2-3 estimate separate coefficients for the OECD and non-OECD countries; Standard errors are clustered by exporting country (with EU countries treated as one country because of its common trade policy). Significance * .10 ** .05 *** .01.