Product Standards and Developing Country Agricultural Exports: The Case of the European Union

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Abstract: This paper shows that private product standards in EU food and agriculture markets can have significant trade effects. In particular for developing countries and for goods that are perishable or only lightly processed, EU standards can often be trade-inhibiting. However, internationally harmonized EU standards—those that are equivalent to ISO norms—have much weaker trade effects, and in some cases are even trade-promoting. At a policy level, our results highlight the importance of dealing with the trade effects of private standards in major markets, not just mandatory public standards.

JEL Codes: F13; O24; Q17.

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1 Introduction

As traditional market access barriers, such as tariffs and quotas, have fallen in many countries over recent decades, attention has increasingly turned to other regulatory measures that have the potential to act as trade barriers. Although rarely designed as explicitly protectionist

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measures, product standards nonetheless have the potential to keep foreign producers out of domestic markets by imposing fixed and variable adaptation costs. These costs have the potential to fall particularly heavily on developing country producers, whose ability to adapt is constrained by technical and financial capacity. Indeed, recent trade theory suggests that fixed cost measures such as product standards might play an important role in explaining the pattern of bilateral trade (Helpman, Melitz and Rubinstein 2008).

Against this background, the relative paucity of quantitative work on product standards is surprising. Moenius (2004) considers a range of industries across a number of developed country markets. He finds that bilaterally shared standards tend to be trade promoting, but that country-specific standards tend to inhibit trade in non-manufactured goods such as agriculture. Czubala, Shepherd and Wilson (2009) examine the impact of EU standards on African exports of textiles, clothing, and footwear. They find that EU standards tend to inhibit African exports, except for those standards that are internationally harmonized. Portugal-Perez, Reyes and Wilson (2009) extend that analysis to electrical products (cf. Moenius 2007), but they do not examine the potential for differential impacts across developing and developed countries. Finally, Shepherd (2007) presents evidence that product standards and international harmonization affect the extensive margin of trade—particularly in developing countries—which is consistent with a significant role for fixed costs of adaptation.

Although there is considerable anecdotal evidence that similar mechanisms may be at work in the food and agriculture sector, quantitative evidence remains scarce. Disdier, Fontagne and Mimouni (2008) find evidence that technical regulations—public, mandatory product standards—can reduce developing country exports. Moenius (2004; 2006) finds that private standards in food and agriculture can be trade-inhibiting in a sample of developed countries.

More recently, Anders and Caswell (2009) show that stricter US food safety standards for seafood have negative impacts on many developing country exporters.

This paper builds on and extends this existing work in four main ways. First, we complement single sector studies such as Anders and Caswell (2009) by covering a wide range of agricultural products from HS Chapters 1-24. Second, we focus on the increasingly important area of private standards, rather than the public standards considered by Disdier, Fontagne and Mimouni (2008). Third, we allow for standards to have different effects on developing and developed country exporters. Fourth, our dataset allows us to identify agricultural product standards that are internationally harmonized versus those that are not, as in Czubala, Shepherd and Wilson (2009) and Portugal-Perez, Reyes and Wilson (2009) for textiles and clothing, and electronic goods respectively.

We use a gravity model and previously unexploited standards data from the European Union to examine the trade impacts of agricultural product standards. In particular, we test the hypothesis that internationally harmonized standards are less trade-restrictive than standards that are not internationally harmonized. Although estimation results vary to some extent across sectors, we generally find support for our hypothesis: ISO-harmonized EU standards tend to have little impact at all on countries' exports, and can even be slightly trade promoting in some cases, whereas non-harmonized standards more often restrict trade. In addition, we find evidence that these results vary across countries according to their level of development. In most cases, developing countries experience a more negative effect than developed countries.

The paper proceeds as follows. In Section 2, we provide an overview of the EU standards system as it applies to agricultural products. We also discuss our data source on EU standards, and provide some basic descriptive results. Section 3 presents our gravity model, and discusses estimation methodology. Section 4 presents results from the gravity modeling exercise, and Section 5 concludes with some policy implications and suggestions for further research in this area.

2 Agricultural Product Standards in the EU: An Overview

Setting product standards is an area of mixed competence in the EU. Each member state sets both voluntary and mandatory standards at a national level, while centralized EU bodies also have the power to set standards with transnational application. Swann, Temple and Shurmer (1996) and Moenius (2004) examine the trade impacts of voluntary national standards, while Chen and Mattoo (2008) and Baller (2007) focus on transnational mandatory standards (Harmonization Directives). Only Czubala, Shepherd and Wilson (2009) and Shepherd (2007) look at the role played by transnational voluntary standards, such as those issued by the European Committee for Standardization (CEN).

CEN is a transnational association established in 1961 by national standards bodies from across Europe. Its standards must be adopted by all EU countries, and override any conflicting or inconsistent national standards. In addition to its work complementing EU Harmonization Directives, CEN is also active in independently developing standards in consultation with industry and national bodies. CEN's output to date is substantial: 12,357 standards and approved documents, with 3,510 more in preparation. By contrast, the European Commission has issued less than two dozen Harmonization Directives under its "New Approach".

To conduct the empirical analysis in the next section, we use previously unexploited data from the World Bank's EU Standards Database (EUSDB).[2] EUSDB collates data on private standards in force in the EU over the 1995-2003 period, and provides the first catalogue of CEN European standards with mapping to a standard trade classification (HS 2000). These standards

[2] The description of the EUSDB given here draws heavily on Shepherd (2006) .

are of the same type studied by Swann, Temple and Shurmer (1996) and Moenius (2004), although their jurisdictional reach is different since they apply to all EU member states. EUSDB covers two product clusters of particular interest to developing countries: agriculture, and textiles and clothing. The first product cluster was analyzed by Czubala, Shepherd and Wilson (2009), who found evidence of significant trade effects. The present paper is the first one to use the agriculture component of EUSDB.

EUSDB is built up from information contained in two primary databases: CE-Norm and Perinorm International. The former is a publicly available (www.cenorm.be), searchable database of European standards, maintained by CEN. Perinorm, on the other hand, is a large (1.1 million records) subscription-only database of standards covering 22 countries, in addition to international bodies such as ISO and CEN.

EUSDB focuses on European product standards at the Community level. It does not include data on national standards from individual Member States. There are three main reasons for this. Firstly, a considerable number of such standards in fact constitute implementations of Community-level standards; although, as Vancauteren (2002) and Vancauteren & Henry de Frahan (2004) point out, divergences amongst national standards within Europe remain a question of considerable concern and are deserving of further research in their own right. Secondly, data availability varies considerably across EU Member States both in terms of years and substance, making it very difficult to obtain a comprehensive dataset covering the full range of Community-level and national standards. Thirdly, Community-level standards are a comparatively recent phenomenon compared with national standardization, thereby making it much more feasible to obtain accurate stock data for the former than for the latter. While Perinorm contains a very small number of national regulations from as far back as the 19th century—some of which could still be in force—its coverage must be regarded as extremely patchy in this regard (Moenius 2000).

Concretely, EUSDB was constructed by searching the CE-Norm and Perinorm databases for Community-level (“EN”) standards, and extracting the relevant information from individual records, then cross-checking. Particular care was taken to ensure that the standard count for each year reflects as accurately as possible the total number of standards in force for that year (referred to as the “stock” of standards), regardless of whether individual standards were published prior to or during the EUSDB sample period (1995-2003). Only those documents classified as “standards” in Perinorm are included in the count data. An amendment to an existing standard is counted as an additional standard. All draft standards are excluded from the dataset.

Some previous studies have differentiated between harmonized (or shared) standards and “idiosyncratic” standards that are unique to a particular country (e.g., Moenius 2000;Moenius 2004). Since EUSDB deals only with Community-level standards, it does not investigate differences in national standards within the EU. However, it does capture information on whether or not a particular EU standard implements a corresponding ISO standard (“international harmonization”). A binary dummy variable is used to make this distinction, which is based on the presence or absence of an “equivalent” or “identical” tag in the Perinorm record with reference to an ISO standard.

One of the most difficult problems in this area is assigning standards to products in a systematic way. As noted by Moenius (2000), the classification schemes used for standards (International Classification for Standards) and goods (HS, SITC, etc.) are based on fundamentally different approaches. The ICS system (International Organisation for

Standardisation 2001) tends to classify standards according to “fields of activity”, often covering a multitude of product groups in HS terms. For example, ICS heading 67 covers standards relating to food technology, which includes not only standards related to specific types of food, but also standards for equipment used in the food industry. The divergent approaches taken by ICS and HS make it extremely difficult to automatically map standards from an ICS-based database like Perinorm or CE-Norm to HS products. Whereas concordances are easily available for different product classifications, there is currently no concordance mapping from ICS to any product or industry classification system.[3]

EUSDB deals with this problem in the following way. Verbal descriptions extracted from Perinorm or CE-Norm are used to map each standard to all corresponding HS 4-digit product codes. Where the product description is judged too vague to be reasonably confident as to its HS equivalents, the corresponding standard is dropped from the database. These verbal descriptions generally provide a much finer level of product detail than is apparent from the corresponding ICS identifier. Moreover, the title of the document can sometimes suggest that the nature of the standard (e.g., “vocabulary” or “terminology”) is purely formal, not substantive, in which case it is dropped from the dataset.

Figure 1 shows that the private standards catalogued in the EUSDB have been growing rapidly over recent years. Summing across all two digit HS sectors in the agricultural products cluster, the total number of standards increased from less than 50 in 1995 to more than 800 in 2003. This represents an average annual growth rate of just over 40%. From the point of view of exporters to the EU, particularly those from developing countries, the expansion in these private agricultural standards is clearly a dynamic with potentially major cost implications. The

[3] Moenius (2000, Appendix C.2) provides a partial concordance from ICS to SITC 2-digit. However, individual ICS codes generally map to a large number of SITC codes, suggesting that the benefits of this approach—transparency and automation—might be partly offset by costs in the form of lost product-level detail.

available firm-level evidence suggests that foreign standards can indeed impose substantial fixed costs of compliance: Maskus, Otsuki and Wilson (2005) report an average of $425,000 per firm, or 4.7% of value added, based on a survey of over 600 firms in 16 developing countries.

[Figure 1 here]

Table 1 presents summary statistics from EUSDB for the final year in the sample (2003), broken down by HS chapter. A small number of product groups stand out for the relatively strong concentration of standards observed: HS Chapters 4 (dairy products), 11 (milling products), 12 (oil seeds), 15 (fats and oils), 19 (preparations of cereals or milk) 20 (preparations vegetables, fruits or nuts). In each case, more than 50 different standards were in force at the end of the sample period. However, our results show that these products are not necessarily most affected by their standards. Considerable heterogeneity exists across sectors in terms of the degree of international harmonization that has taken place. In HS Chapter 23 (food industry residues), for instance, nearly all EU standards are harmonized with ISO norms (96%). The corresponding figure is over 40% for HS Chapters 4 (dairy products) and 15 (animal and vegetable fats and oils), but is much lower in other sectors. For nine of the 18 sectors with at least one standard in force in 2003, the rate of ISO harmonization is zero. On an overall basis, the percentage of ISO-harmonized standards in the total has actually fallen over time: from just under 70% in 1995 to around 17% in 2003.

Part of the reason for the rapid increase in non-ISO standards relative to ISO standards is that some products do not have ISO standards. Table 1 shows, for instance, that fish products only face non-ISO standards. More common in agriculture, though, is that the number of non-ISO standards increased at a faster rate than the number of ISO standards. In oil seeds and oleaginous fruits, for example, at the beginning of the data set the EU only had ISO standards.

By the midpoint of the data period, the number of non-ISO standards outstripped the ISO standards, so that at the end of the data period of the total of all standards, the percentage of ISO standards was 27% while non-ISO standards was at 73%.

[Table 1 here]

The overall growth in the number of standards, as well as the realignment that has taken place between the two types of standards, suggest a real shift in the regulatory hurdles that the EU imposes on exporting countries in food and agricultural trade. The next section of the paper rigorously develops a gravity model to examine more carefully the trade impacts of these changes.

3 The Gravity Model

Anderson and van Wincoop (2003) develop a theory-consistent gravity model based on constant elasticity of substitution (CES) demand in a general equilibrium structure. Using *i*, *j*, *k*, and *t* to index exporters, importers, sectors, and time respectively, the log-linearized version of their model takes the following form:

(1)
$$\log\left(X_{ijt}^{k}\right) = \log\left(E_{jt}^{k}\right) + \log\left(Y_{it}^{k}\right) - \log\left(Y_{t}^{k}\right) + (1 - s^{k})\log\left(t_{ijt}^{k}\right) - (1 - s^{k})\log\left(P_{jt}^{k}\right) - (1 - s^{k})\log\left(\Pi_{it}^{k}\right) + e_{ijt}^{k}$$

where: X_{ijt}^{k} is exports from country i to country j in sector k at time t; E_{jt}^{k} is sector k expenditure in country j; Y_{it}^{k} is sector k production in country i; t_{ijt}^{k} is bilateral trade costs in sector k; s^{k} is the intra-sectoral elasticity of substitution (between varieties within a sector); and e_{ijt}^{k} is a random error term satisfying standard assumptions. The P_{jt}^{k} and Π_{it}^{k} terms represent multilateral resistance, i.e. the fact that trade patterns are determined by the level of bilateral trade costs relative to trade costs elsewhere in the world. Inward multilateral resistance $(P_{jt}^{k})^{(1-s^{k})} = \sum_{i=1}^{N}\left(\Pi_{it}^{k}\right)^{(s^{k}-1)} w_{it}^{k}\left(t_{ijt}^{k}\right)^{(1-s^{k})}$ captures the dependence of country *j*'s imports on trade costs across all suppliers. Outward multilateral resistance $(\Pi_i^k)^{(1-s^k)} = \sum_{i=1}^{N} \left(P_{jt}^k\right)^{(s^k-1)} w_{jt} \left(t_{ijt}^k\right)^{(1-s^k)}$ captures the dependence of country i's exports on trade costs across all destination markets. The w terms are weights equivalent to each country's share in worldwide sectoral output.

Since the two multilateral resistance terms are unobservable, it is common to estimate (1) using fixed effects. As Baldwin and Taglioni (2007) point out, it is important to ensure as close a correspondence as possible between the theoretical model and the dimensions of the fixed effects when estimating using sectoral data. Ideally, equation (1) would be estimated separately for each sector *k*, with a full set of importer-time and exporter-time fixed effects. Such an approach allows for the proper level of variation in multilateral resistance, and also takes account of the fact that the elasticity of substitution varies across sectors. However, a cost of that methodology in our context is that it would produce a very large number of regression results—one for each four digit product code in the first 24 chapters of the Harmonized System—which makes overall interpretation difficult. In addition, the inclusion of importer-time dummies in product regressions would make it impossible to include measures of CEN standards from EUSDB, which are implemented on an MFN basis: they are constant across all exporters, and would be collinear with the fixed effects.

We therefore adopt a compromise strategy. We estimate (1) separately for each two-digit HS sector, i.e. using data pooled across all four digit products within a sector. We include fixed effects in the exporter-product, importer, and time dimensions. Although conscious that this specification does not exactly mirror the dimensions of the theoretical model, we believe that it represents an appropriate compromise between rigor and feasibility in the context of a model with many countries, sectors, and years, in which the number of fixed effects can quickly become burdensome.

To operationalize (1), we need to specify the content of the trade costs function t_{ijt}^{k}:

$$t_{ijt}^{k} = b_1 \log(ISO_t^k) + b_2 \log(NonISO_t^k) + b_3 \log(dist_{ij}) + b_4 colony_{ij} + b_5 language_{ij} + b_6 contiguous_{ij} + b_7 RTA_{ijt} \quad (2)$$

In line with the gravity model literature, we use distance ($dist_{ij}$) as a proxy for international transport costs. We also include dummy variables for countries that were previously in a colonial relationship, those that share a common official language, those that are geographically contiguous, and those that are both members of the same regional trade agreement. (For a full description of variables and data sources, see Table 2.)

Our main variables of interests are two counts of product standards drawn from EUSDB. The first one (ISO_t^k) counts the number of ISO-harmonized CEN standards in force for a given product-year combination, and the second ($NonISO_t^k$) counts the number of non-ISO-harmonized CEN standards.[4] The reason for entering them separately into the trade costs function is that based on the results of Shepherd (2007), and Czubala, Shepherd and Wilson (2009), we expect the cost impacts of these two types of standards to be different, and thus their trade impacts to differ. Since internationally harmonized standards make it possible for firms to enter multiple markets upon payment of a single product adaptation cost, we expect them to be less burdensome to foreign exporters than non-harmonized standards. Concretely, we expect $b_1 > b_2$ in terms of equation (2).

[4] Some sector-year combinations have a zero count for one or other of these variables. To deal with this problem, we add 0.00001 to the number of standards prior to taking the logarithm. Absent this adjustment, those observations would be dropped from the dataset.

Combining (1) and (2), adding reduced form coefficients, and removing variables that are accounted for by fixed effects gives our final estimating equation:

$$X_{ijt}^{k} = \sum dum_i^k + \sum dum_j + \sum dum_t + \mathrm{b}_1 \log(\mathrm{ISO}_\mathrm{t}^\mathrm{k}) + \mathrm{b}_2 \log(\mathrm{NonISO}_\mathrm{t}^\mathrm{k}) + \mathrm{b}_3 \log(\mathrm{dist}_\mathrm{ij}) + \mathrm{b}_4 \mathrm{colony}_\mathrm{ij} + \mathrm{b}_5 \mathrm{language}_\mathrm{ij} + \mathrm{b}_6 \mathrm{contiguous}_\mathrm{ij} + \mathrm{b}_7 \mathrm{RTA}_\mathrm{ijt} + e_{ijt}^{k} \quad (3)$$

where *dum* under a summation operator indicates a full set of dummy variables (fixed effects) in the listed dimension.

We estimate (3) using the Poisson pseudo-maximum likelihood estimator (Silva and Tenreyro 2006) with fixed effects (Simcoe 2008). Poisson has two main advantages over OLS as a workhorse estimator for the gravity model. First, estimating a log-linearized gravity model like (3) using OLS makes it necessary to drop observations in which the dependent variable is equal to zero in levels, since log(0) is undefined. Poisson does not suffer from this limitation, and zeros can be included in the dataset in the same way as observations with any other value. Second, Santos Silva and Tenreyro (2006) argue that in the presence of a certain type of heteroskedasticity, OLS can in fact produce biased parameter estimates in addition to the usual biased standard errors. They show empirically that there is good reason to believe that this type of heteroskedasticity is present in typical gravity model samples. Poisson, however, is consistent under much weaker assumptions, and is thus more likely to give robust results than OLS in this context.

We ran this model first on all exporting countries to the EU. Then we ran two additional models: one for developed country exporters, and another for developing country exports. In our data set developed countries are ones designated high income economies and developing countries are the others in our data set (World Bank 2009).

[Table 3 here]

4 Results and Interpretation

Most of the typical gravity model coefficients are statistically significant and have the correct sign (lnDistance is negative, while Colony, Language, Border and RTA are positive). The Wald test in each regression rejects the null hypothesis that all of the parameters are equal to zero at the one percent alpha level. Overall, we see that non-ISO standards have negative and statistically significant effects on the trade of agricultural and food products. In the instances that ISO standards are statistically significant, they are positive (See Table 3 and Figure 2). In short, non-ISO standards tend to stifle trade, but ISO standards either have very limited, or even positive, trade effects. This pattern also holds when developed and developing countries are considered separately (See Figures 3 and 4).

[Figure 2 here]

In Table 3, we present the estimates of the PPML, fixed effects model for all countries exporting agricultural products to the EU. We suppress regressions where no standard is imposed by the EU, and the fixed effects coefficients.[5] In only two cases out of seven does the ISO standard have a statistically significant effect. This result suggests that for the most part ISO standards do not have an effect on trade of food products; however, for HS Chapters 4 (dairy products) and 23 (food residues), the adherence to international standards has a small positive effect on the trade of these products. This result is different than the result of ISO standards on clothing and textile products (Czubala, Shepherd and Wilson 2009).

In fifteen of the seventeen cases of the non-ISO standards, the coefficient is statistically significant. Of those coefficients that are statistically significant, only three are positive: HS

[5] These are available upon request of the authors. The model for cereals HS 10 did not converge so we have omitted its results.

Chapters 3 (fish), 17 (sugars), and 22 (beverages). The majority of the coefficients on non-ISO standards are negative and statistically significant.

As readily seen in Figure 2, the coefficients, which are also elasticities, are mostly elastic and in the range of -1.3 to -1.6. In all of these cases the total number of standards is between 39 and 41. The three exceptions are HS Chapters 20 (preparations of vegetables, fruit or nuts), 22(beverages); and 23 (residues). The preparations of vegetables, fruits or nuts had 74 standards by the end of the data set, but the coefficient is the smallest, in absolute terms, of the statistically significant coefficients. Beverages (3 standards) and residues (1 standard) had the smallest number of non-ISO standards by the end of the period. The coefficient on beverages is positive while the coefficient on residuals is negative and is the second smallest in absolute terms. Therefore, small numbers of standards (1-3) and a large number of standards (74) seem to have relatively little effects on trade. However, products with 39 to 42 standards have the most dramatic effects on trade.

[Figures 3 and 4 here]

Estimating the one model with all countries may obscure the effects of standards on different countries based on their level of development. Therefore, we re-estimate the models on two data sets: developed country and developing country exporters. We present the results of these models in Figures 3 and 4. For the most part the results are similar to the combined data set. In most cases the non-ISO standard lowers trade. ISO standards are statistically significant and positive. Depending on the product, ISO and non-ISO standards have differential effects on different exporters. For more perishable, less processed products HS Chapters 2, 3, 7, 9, and 12, non-ISO standards tend to have a larger effect on developing country exporters than on developed country exporters.

The most striking result in this light is for HS Chapter 3 (fish). In the combined model, the coefficient on non-ISO standards is 4.699. However in the separate data sets, developed countries have a coefficient for non-ISO standards of 5.131 while the coefficient for developing countries is statistically insignificant. In this case, trade from developing countries is not affected by the standards; however, as EU imports of fish increase, developed countries are the exporters that gain. By extension, developing countries lose market share to a valuable product market as a result of increased non-ISO standards. In less dramatic cases such as HS Chapters 2 (meat), 8 (vegetables) and 9 (coffee and spices), the coefficient of the non-ISO standard is more negative for developing countries than for developed countries.

Two other perishable and relatively raw products of note are HS Chapters 4 (dairy products) and 8 (edible fruit and nuts). Non-ISO standards have a stronger negative effect on these products for developed countries relative to developing countries. This result is surprising given the hypothesis that developed countries are less negatively affected by standards than developing countries. Another somewhat surprising result is the relatively large ISO coefficient for HS Chapter 12 (oilseeds) for developing countries. Further analysis of the four-digit, or more disaggregated data, may explain this result.

With the exception of HS Chapters 18 (cocoa) and 21 (miscellaneous edible preparations), the more processed products HS Chapters 14-HS24 are not as negatively affected as less processed, more perishable products HS Chapters 1-13. Additionally, more of the positive coefficients related to ISO and non-ISO standards are estimated for the more processed products. As it relates to developed versus developing countries, no clear pattern holds for how the standards affect developed versus developing countries based on the level of processing of the product. Non-ISO standards lower trade of developed countries more so than developing countries for cocoa. However, the coefficients are virtually the same for miscellaneous edible production. As seen in residues and waste, developing countries may have experienced an overall increase in trade based on the relatively larger positive coefficient for ISO (0.058) to non-ISO (-0.38). Developed countries only had a statistically significant and positive effect from the ISO standards (0.27)

5 Conclusion

This paper has provided some of the first evidence on the trade impacts of private food and agriculture standards in the EU. The general thrust of our results accords well with the previous literature on other types of standards and trade: internationally harmonized EU standards tend to have weak, or even slightly positive, trade impacts, where as non-harmonized standards—those that are unique to the EU—tend to be trade inhibiting. However, we also find considerable evidence of cross-sectoral heterogeneity. In particular, the trade impacts of non-harmonized EU standards tend to be particularly negative for products that are only lightly processed. More highly processed goods are less affected by EU standards, even though the total number of standards is considerably larger in processed goods sectors. In addition, we find that for less processed products, non-harmonized standards tend to have a larger effect on developing country exporters than on developed country exporters.

From a policy point of view, at least two implications flow from our results. The first is that discussions on product standards at the WTO and elsewhere need to be broadened to take account of the important role that private standards play in influencing global trade patterns in food and agriculture markets. Most policy-level discussion is limited to dealing with mandatory public standards, such as food safety regulations. However, our results show that in a context of increasingly globalized supply chains, private standards also matter.

Second, our results highlight the way in which, particularly for developing countries, product standards can effectively make market access gains conditional: Malawi has duty and quota free access to the EU market under the Everything But Arms initiative, but if its exporting firms actually want to sell products in the European market, then they need to comply with the prevailing standards. Adapting products and production methods to deal with overseas standards raises serious issues of technical and financial capacity for many developing countries. But as our results show, the trade impacts of EU standards tend to be particularly negative for developing countries in the sectors that are of most current export interest to them: perishable goods and relatively unprocessed commodities. There is clearly a case to be made for increased technical assistance and capacity building in this area, as part of the broader Aid for Trade agenda.

Future work in this area could extend our findings in a number of ways. First, our dataset covers the EU only, but standards are clearly an issue in other developed country markets too. Additional research that exploits the availability of data for the US and other countries in the Perinorm database would be of particular interest, and would complement previous cross-country work on mandatory, public standards.

A second issue that we have abstracted from here, but which is deserving of research in its own right, is the dynamics of adjustment to changes in overseas standards. Although the impact effect of new or tightened foreign standards is likely to be negative, particularly in the developing country context, the overall impact over time may well be different: standards can also act as a catalyst for technical change and supply chain upgrading, with beneficial effects for those producers in a position to comply with them. Further investigation of such effects in the context of trade and development policies would be particularly welcome.

Tables

Table 1: Count data on the number of EU standards in force in 2003, by HS Chapter. (Source: EUSDB.)

HS Chapter	Description	ISO	Non-ISO
01	Live animals	0	0
02	Meat and edible meat offal	0	39
03	Fish and crustaceans, mollusks and other aquatic invertebrates	0	40
04	Dairy produce; birds’ eggs; natural honey;	34	39
05	Products of animal origin, not elsewhere specified	0	0
06	Live trees and other plants;	0	0
07	Edible vegetables and certain roots and tubers	0	41
08	Edible fruit and nuts; peel of citrus fruit or melons	0	41
09	Coffee, tea, maté and spices	0	41
10	Cereals	2	42
11	Products of the milling industry; malt; starches; inulin	22	41
12	Oil seeds and oleaginous fruits	15	41
13	Lac; gums, resins and other vegetable saps and extracts	0	0
14	Vegetable plaiting materials; vegetable products nes	0	0
15	Animal or vegetable fats and oils	30	44
16	Preparations of meat, of fish or of crustaceans	0	39
17	Sugars and sugar confectionery	1	40
18	Cocoa and cocoa preparations	0	39
19	Preparations of cereals, flour, starch or milk; bakers' wares	13	41
20	Preparations of vegetables, fruit or nuts	0	74
21	Miscellaneous edible preparations	2	39
22	Beverages, spirits and vinegar	0	3
23	Residues and waste from the food industries	25	1
24	Tobacco and manufactured tobacco substitutes	0	0

Table 2: Data and sources.

Variable	Definition	Year	Source
Border	Dummy variable equal to unity for exporting and importing countries with a common land border.	n/a	CEPII
Colony	Dummy variable equal to unity when the exporter and importer were once in a colonial relationship.	n/a	CEPII
Exports	Value of exports from the exporter to the importer, measured at the HS four-digit level.	1995-2003	EUROSTAT
ISO	Count of the number of ISO-harmonized CEN standards, by HS four-digit product.	1995-2003	EUSDB
Language	Dummy variable equal to unity for exporting and importing countries with a common language (official basis).	n/a	CEPII
NonISO	Count of the number of non-ISO-harmonized CEN standards, by HS four-digit product.	1995-2003	EUSDB
RTA	Dummy variable equal to unity for country pairs that belong to the same regional trade agreement.	1995-2003	Authors

Table 3: Poisson Pseudo-Maximum Likelihood (PPML) Fixed-Effects Models, Aggregated from Four-Digit HS Products Estimates

	HS2	HS3	HS4	HS7	HS8	HS9	HS11	HS12	HS15
lnDistance	-0.32*	-1.19***	-0.51***	-0.37***	-0.32**	-0.19	-0.50***	0.088	0.24
	(0.098)	(0.000)	(0.000)	(0.001)	(0.004)	(0.252)	(0.000)	(0.465)	(0.152)
lnISO			0.012*				-0.009	0.556	-0.014
			(0.067)				(0.498)	(0.157)	(0.470)
LnNonISO	-1.65***	4.70**	-1.45***	-1.52***	-1.42***	-1.58***	-0.024*	-0.064***	-0.009
	(0.000)	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)	(0.020)	(0.0.001)	(0.369)
Colony	0.537	0.572**	1.035**	1.161***	1.029***	0.521*	0.091	0.177	-0.661*
	(0.104)	(0.005)	(0.005)	(0.000)	(0.000)	(0.067)	(0.773)	(0.429)	(0.045)
Language	0.359*	0.466*	0.406	0.578**	0.076	0.535*	0.643*	0.308	1.931***
	(0.089)	(0.015)	(0.135)	(0.007)	(0.608)	(0.080)	(0.015)	(0.231)	(0.000)
Border	0.528**	0.315*	0.505*	0.527***	0.484**	0.862***	1.228***	0.705**	0.247
	(0.004)	(0.078)	(0.062)	(0.000)	(0.003)	(0.000)	(0.000)	(0.036)	(0.210)
RTA	0.585*	0.092	0.362*	0.019	0.019	0.196*	0.223*	0.265**	-0.391***
	(0.016)	(0.172)	(0.053)	(0.871)	(0.792)	(0.068)	(0.047)	(0.025)	(0.000)
N	190,377	263,655	189,603	393,932	431,640	272,250	177,516	321,318	39,308

The p-values based on robust standard errors, adjusted for clustering by country-pair, are in parentheses. Statistical significance is indicated by: * (10%), **(5%), and *** (1%).

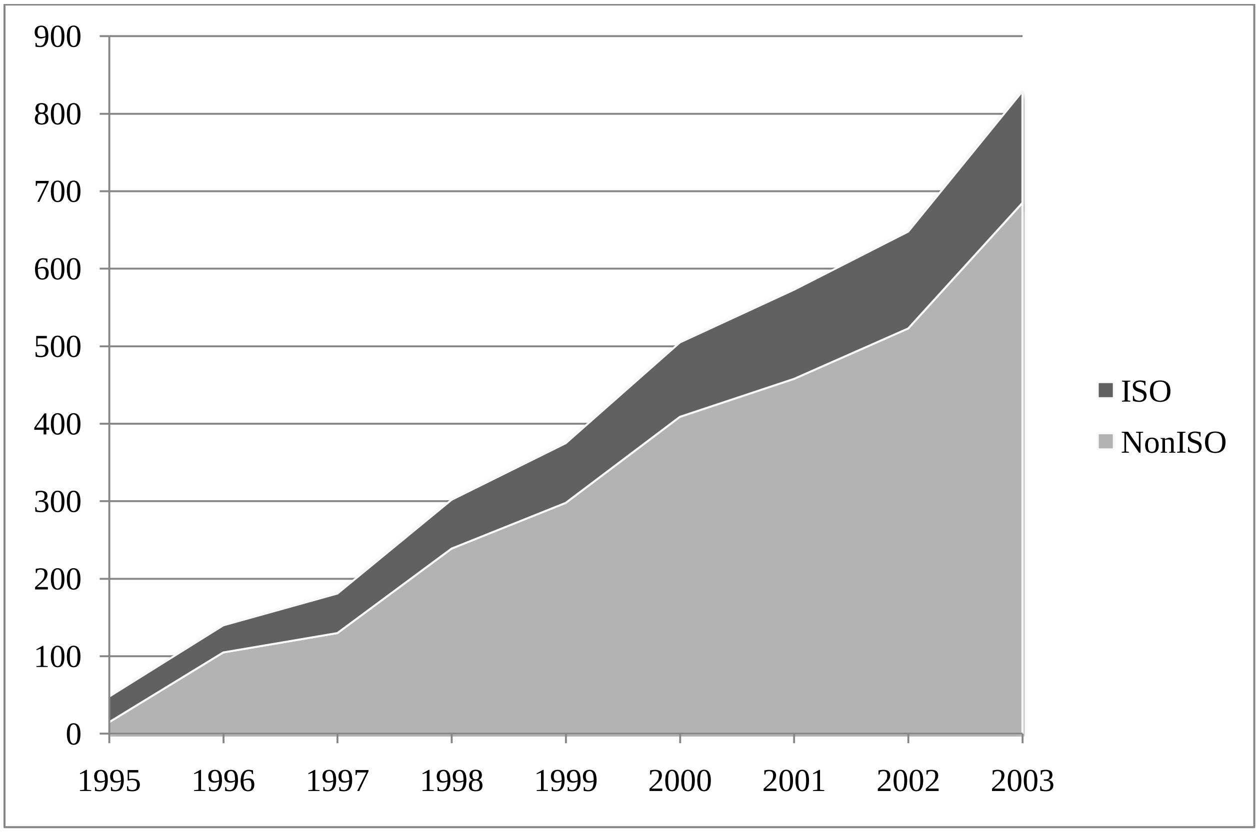
Table 4: Poisson Pseudo-Maximum Likelihood (PPML) Fixed-Effects Models, Aggregated from Four-Digit HS Products Estimates

	HS16	HS17	HS18	HS19	HS20	HS21	HS22	HS23
lnDistance	-0.52**	-0.34*	0.10	-0.041	-0.139	-0.63***	-0.53**	-0.39**
	(0.001)	(0.014)	(0.701)	(0.802)	(0.444)	(0.000)	(0.004)	(0.005)
lnISO				-0.012		-0.005		0.026**
				(0.169)		(0.476)		(0.002)
LnNonISO	-1.381***	0.011**	-1.463***	-0.003	-0.019***	-1.401***	0.010*	-0.027**
	(0.000)	(0.004)	(0.000)	(0.546)	(0.000)	(0.000)	(0.026)	(0.004)
Colony	1.092***	0.212	0.631*	-1.362*	0.900***	-0.227	0.305	0.266
	(0.000)	(0.132)	(0.067)	(0.049)	(0.000)	(0.292)	(0.356)	(0.274)
Language	0.918***	0.398**	0.089	2.446***	0.152	0.698***	1.068***	0.435*
	(0.000)	(0.001)	(0.745)	(0.000)	(0.543)	(0.000)	(0.000)	(0.011)
Border	0.827***	0.446***	1.320***	-0.209	0.684***	0.414*	0.151	1.143***
	(0.000)	(0.000)	(0.000)	(0.424)	(0.001)	(0.068)	(0.445)	(0.000)
RTA	0.207***	-0.054*	0.227	0.563***	-0.121	0.235*	-0.178*	-0.048
	(0.001)	(0.065)	(0.498)	(0.000)	(0.200)	(0.088)	(0.067)	(0.724)
N	122,283	112,275	130,914	129,105	260,262	167,913	283,743	168,642

The p-values based on robust standard errors, adjusted for clustering by country-pair, are in parentheses. Statistical significance is indicated by: * (10%), **(5%), and *** (1%).

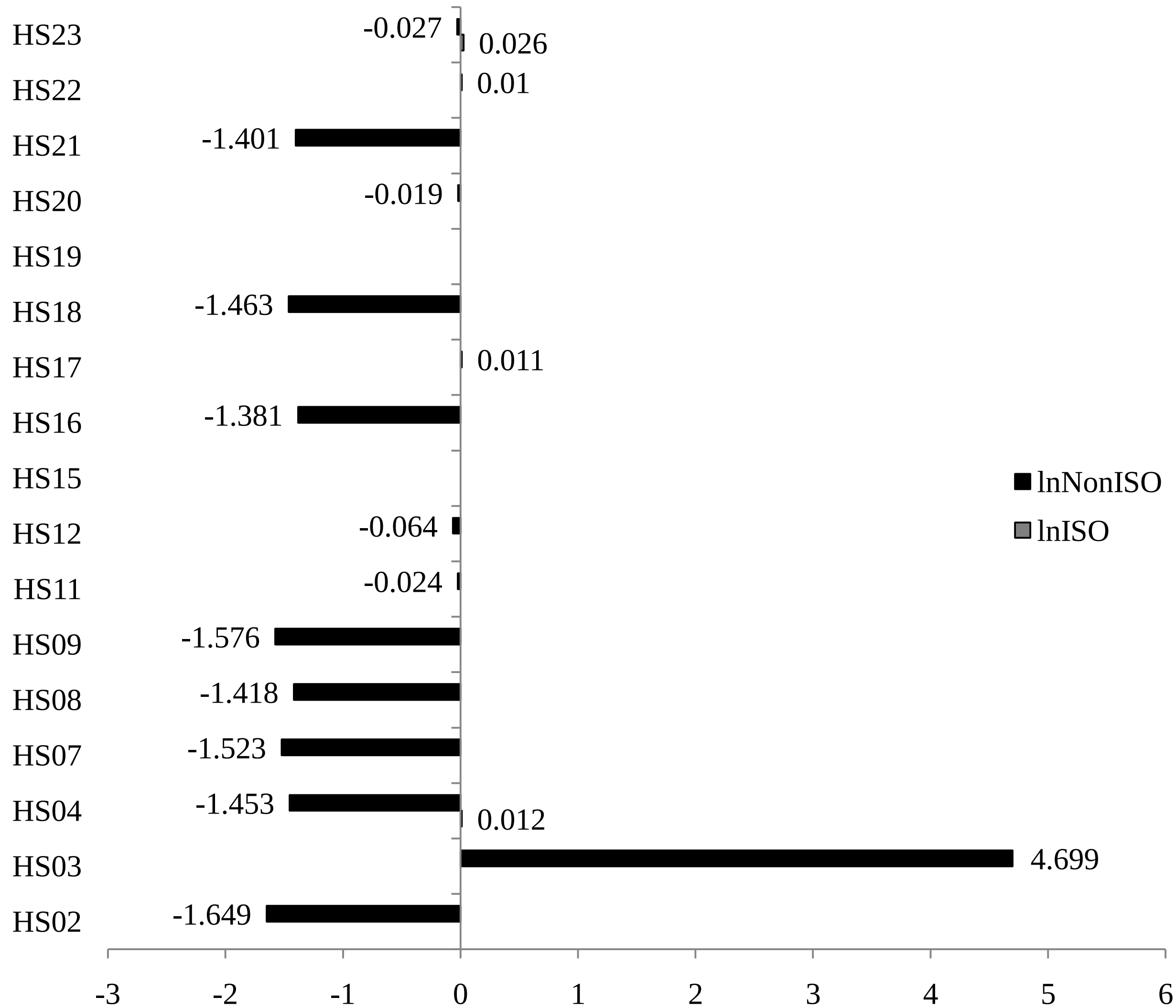
Figures

Figure 1: ISO and non-ISO product standards for HS Chapters 1-24, 1995-2003.



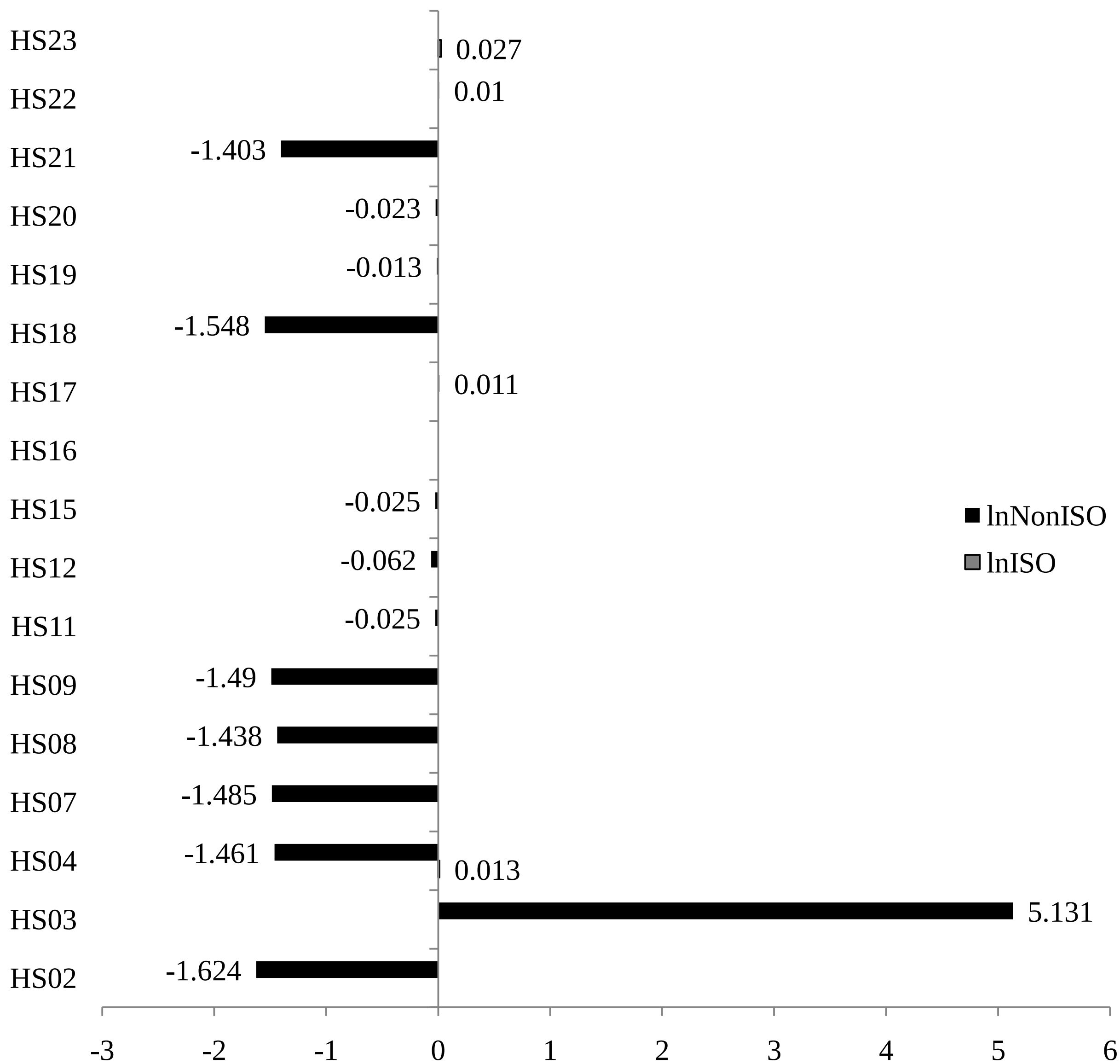
Source: EUSDB.

Figure 2: **Coefficients of ISO and Non-ISO for All Countries**.



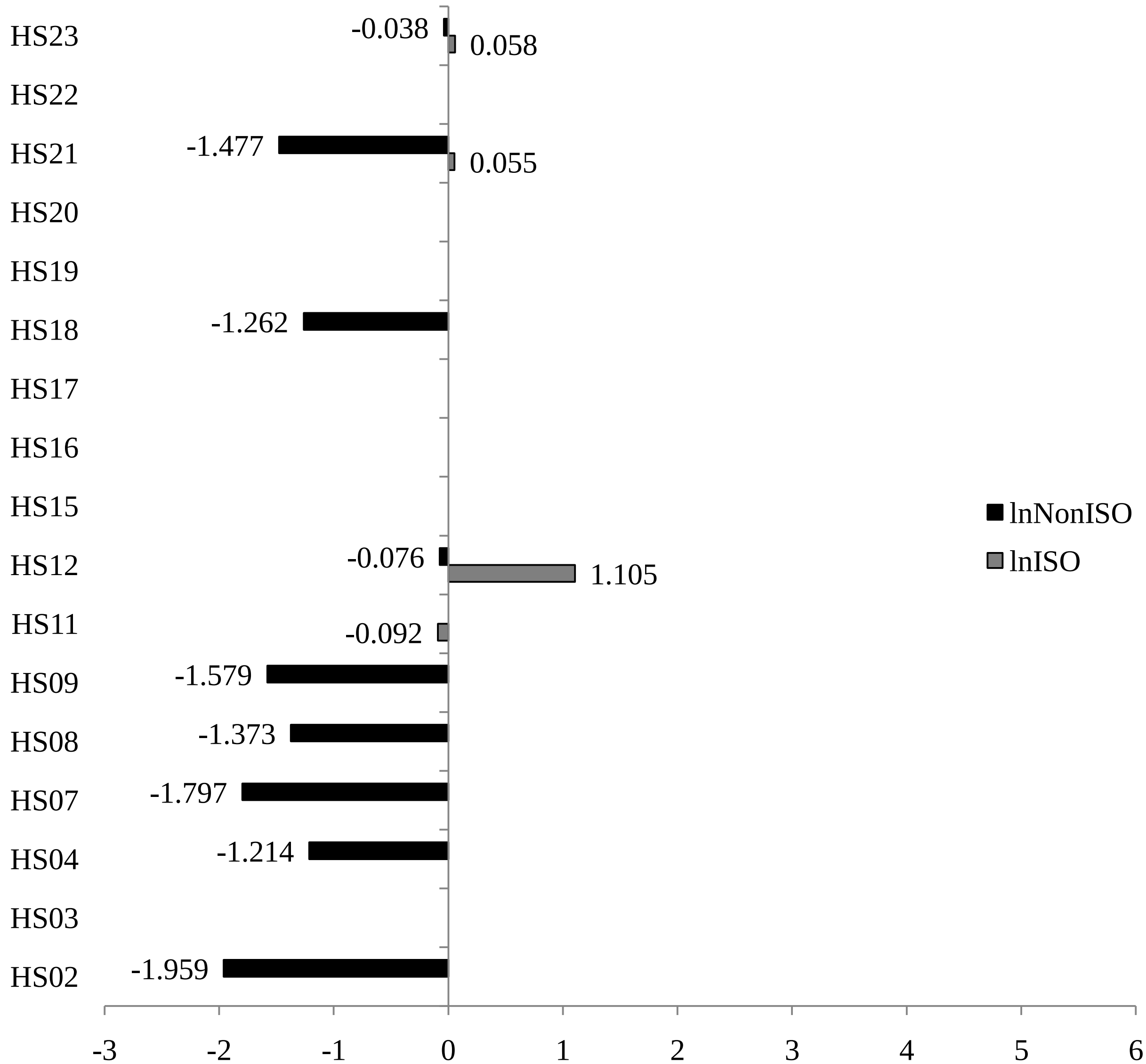
Source: Authors' Estimates

Figure 3: Coefficients of ISO and Non-ISO for Developed Countries.



Source: Authors' Estimates

Figure 4: Coefficients of ISO and Non-ISO for Developing Countries.



Source: Authors' Estimates

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