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The Role of Standards in North-South Trade: The Case of Agricultural Exports from Sub-Saharan African Countries to the EU

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Abstract

The impact of product and production standards on trade flows is of critical relevance for developing countries aiming at a higher participation in world trade. While economic theory suggests that the effect of standards on trade can entail two opposing forces, acting either as non-tariff barrier to trade or as a competitive advantage on the world market, empirical evidence on the trade effect of standards remains ambiguous. We contribute to the literature by scrutinizing a set of 132 international agricultural standards, and their impact on export flows of the four main agricultural export products from Sub-Saharan African (SSA) countries to the EU. Our analysis includes cocoa, fruits, vegetables and coffee. We apply the gravity model of trade via the Poisson Pseudo Maximum Likelihood (PPML) estimator to both an aggregate estimation of the four product groups, as well as a product-specific estimation. The aggregate estimation yields a twofold result on the impact of standards on export flows: In a given year, the introduction of any of the standards in the EU leads to a significant reduction in exports, while the count of the standards in place in the EU has a significantly positive effect. This result is less distinct for the product-specific estimation, yielding both significantly positive and significantly negative impacts when analysing the impact of the 132 standards separately. Additionally, our results show that the SSA producers' '*ability to comply*' with international standards positively impacts agricultural export flows. Moreover, we find a positive interaction between the effect of the introduction of any of the standards and the '*ability to comply*'. This implies that a high '*ability to comply'* with international standards can mitigate negative effects, or promote positive effects, on SSA export flows in instances when a standard is introduced in the EU.

Keywords: Agricultural Trade, International Standards, Gravity Models

JEL-Codes: F14, Q17

Introduction

The ongoing multilateral trade liberalization and tariff cuts have been accompanied by an increase of non-tariff barriers (NTBs) to trade. While trade barriers are no longer in the form of tariffs, they now emerge in the form of common minimum standards (Keynes, 2016). Standards and technical regulations[1], which are applied to mitigate against health and environmental risks, to prevent deceptive practices and to reduce transaction costs in business, are components of NTBs and are commonly seen as an increasingly important determinant of trade flows (World Bank, 2008 and Gandal & Shy, 2001).

The significance of standards is amplified by the increasing fragmentation of production processes worldwide and complicated by the diverse nature of standards. While public standards referenced in legislation are mandatory technical regulations and, hence, directly determine market access, other public standards are voluntary. Moreover, private standards, which are set by companies within value chains are predominantly voluntary in nature, but are becoming de facto mandatory for market access. The specific role of standards in trade is fittingly summarised by Henson & Jaffee (2008) who point to the crude dichotomy between 'standards as barriers' and 'standards as catalysts'. The catalytic aspect of standards stems from their power to enable market access and the participation in higher value added stages within global value chains (GVCs). This is critically important for Sub-Saharan African (SSA) countries who want to reach greater participation in world markets and higher value added stages of GVCs.

As a major export destination, the mandatory standards for market access to the European Union (EU) likely influence export opportunities for SSA countries. Thus far, empirical research on the role of standards as either barrier or catalyst to trade has produced ambiguous results. We add to the existing literature by empirically analysing the impact of public standards on exports from SSA countries to the EU, thereby investigating the significance of these standards with respect to EU market access for SSA countries. The 132 public standards we use for our analysis are EU adopted British Standards Institution (BSI) standards, which are predominantly equivalent to International Organization for Standardization (ISO) standards.[2] Being both public and equivalent to international standards, we henceforth refer simply to "standards", the exception being when we reference ISO specific standards as "international standards". With market access being an important determinant

[1] The WTO Agreement on Technical Barriers to Trade (TBT) defines standards as guidelines for products or production process which are not mandatory, while the compliance with technical regulations is mandatory (WTO, 2017).

[2] Data provided to the authors upon request to the British Standards Institute (David Priest, Information Specialist). Of the 132 BSI standards, only 5 are BSI specific, and the remaining 127 are either ISO and/or EN standards.

of income per capita and average wages, the relevance of our research objective is amplified by the developmental significance for SSA countries (Redding & Venables, 2004 and Mayer, 2008).

Since the economies in SSA are predominantly agriculture based, we focus on the SSA's four biggest agricultural export groups to the EU: (1) *Cocoa and cocoa preparations*, (2) *Edible fruits, nuts, peel of citrus*, (3) *Edible vegetables and certain roots* and (4) *Coffee, tea, mate and spices*. We include two estimation strategies: first, we analyse aggregate export flows of these four product groups and, subsequently, we analyse each product group separately. The standards used in our analysis are all applicable to one, or more, of the four agricultural groups. We apply a standard gravity model of trade through Poisson Pseudo Maximum Likelihood (PPML) estimation, including 49 countries (39 SSA exporters and 10 EU importers) over the 1980-2012 time horizon.

The first model specification assesses the impact of the standards on export flows by including different standard variables: the introduction of any standard in the EU countries in a particular year, the count of standards in place in a given year and the separate consideration of the introduction of each of the 132 standards. The second step extends the model by including the '*ability to comply*', a proxy variable capturing the SSA producers' ability to comply with international standards, as well as an interaction term between the '*ability to comply'* proxy and the variable capturing the introduction of any standards in the EU countries in a particular year. The first specification of the proxy includes the absolute and relative numbers of ISO 9001 (Quality Management Systems) and ISO 14001 (Environmental Management Systems) certificates in the SSA countries, which certify the compliance to international process standards. We assume a higher number of these certificates in the SSA countries is indicative of a relatively higher '*ability to comply*' with international standards. The second specification for the proxy addresses the degree of business sophistication and includes the sectoral value added shares (in % of GDP) of agriculture, services and manufacturing. Here, we assume higher shares of value added in these sectors indicate enhanced business sophistication and, hence, facilitate the compliance with international standards.

Regarding the impact of standards on export flows, we find contrasting effects. While the introduction of any standard in the analyzed EU countries in a year leads to a significant decrease of agricultural exports from SSA countries to the EU, the count of the standards in place in a given year has a significantly positive impact on SSA countries' agricultural exports. This is more evident at the aggregate estimation level, however, when considering the introduced standards separately, we find both negative and positive impacts on agricultural export flows. Furthermore, our results show that the '*ability to comply*' with international standards significantly and positively impacts the product-specific export flows. This is especially evident for the first set of proxies on the adherence to international standards. The positive impact of the '*ability to comply*' on the effect of standards on

export flows becomes most evident in the robustness check when we run regressions on 3-year interval data. The results suggest a high '*ability to comply'* both mitigates the negative effects on SSA export flows, and promotes the positive effects on SSA export flows when a standard is introduced in the EU.

The remainder of the paper outlines the theoretical background analysing the role of standards in international trade and, thereafter, we review the results of existing studies. Subsequently, we formulate our hypotheses before outlining our econometric approach, providing our results and lastly, our discussion of these results.

The role of standards in international trade

General facts on standards

A standard is defined as a rule that provides requirements, specifications or guidelines concerning production processes, materials and products (ISO, 2015) and compliance with certain product or production standards is, therefore, crucial for market access for companies. While standards can be public or private in nature, public standards are set by governments, whereas private standards are driven by large firms, retailers or civil society demands. Public standards are voluntary, but when referenced in legislation, become mandatory technical regulations. Private standards are also voluntary, but are becoming de facto mandatory due to their high prevalence within GVCs (Liu, 2009).

Despite the EU being the most open market in the world for developing country exports[3], and despite trade between the SSA countries and the EU being promoted by the Africa-EU Partnership, as emphasized in the Cotonou Agreement[4&5], SSA exporters to the EU still need to prove compliance with EU rules (public standards) to gain access to the single market. The "Blue Guide" on the implementation of EU product rules states that irrespective of their origin, products must be compliant with the applicable EU harmonisation legislation if made available on the EU market (European Commission, 2016b). Therefore, standards and standard compliance is particularly crucial for developing countries who want to participate more significantly in world trade.

To what extent standards impact trade flows and export prospects for developing countries, in general, has been widely discussed in the economic literature (Chen et al., 2006 and Swann, 2010), yet the evidence on the effects of standards on trade and market access is limited and divided

[3] According to: http://trade.ec.europa.eu/doclib/docs/2012/january/tradoc_148990.pdf

[4] Forty-eight SSA countries belong to the EU's comprehensive Cotonou Agreement (2000-20), which covers different types of cooperation including: development initiatives, trade and economic exchanges and cooperation of a more political nature (European Commission, 2016c).

[5] A dummy variable was included for the Cotonou Agreement as part of our robustness checks, but the variable proved insignificant.

(Moenius, 2004). The theoretical literature proposes opposing explanations on the effect of standards on trade and this is amplified by empirical evidence, which yields mixed results for different kinds of standards. These opposing stances are documented in the subsequent sub-sections.

Theoretical background on the effects of standards on trade

From a theoretical point of view, the effect of standards on trade is ambiguous (Moenius, 2004). While the *competitive disadvantage hypothesis* assumes standards have a trade deterring effect, the *competitive advantage hypothesis* refers to standards as a factor of non-price competitiveness with a trade promoting effect[6] (Swann et al., 1996).

Standards as non-tariff barriers: *The competitive disadvantage hypothesis*

The *competitive disadvantage hypothesis* predicts that standards will negatively affect trade, since they are a non-tariff barrier (NTB).[7] This particularly applies to country-specific standards of the importing country (Harrigan, 1993; Casella, 1997 and Moenius, 2004). Not only do standards negatively affect trade by the costs which arise from the need for standard compliance (Blind, 2004), but the numerous aspects regarding standards make compliance itself tricky. Compliance involves investment in equipment and staff and additional costs related to conformity assessment. For the bearer[8], these compliance costs directly influence production costs and may alter the relative gains or benefits that accrue to producers and consumers. For developing countries, in particular, this must be understood because of the underestimated persistent, even increasing, access barriers to their export markets (ITC, 2003). Moreover, the requirements and associated compliance costs are likely to increase the production costs of firms supplying these markets or entering new ones. This can be particularly severe for small- and medium-sized enterprises. These increased costs for exporters then result in a decreased competitiveness of the firms, which subsequently reduces exports and inhibits trade flows (Lecraw, 1987; Swann et al., 1996 and Cipollina et al., 2016).

On the other hand, harmonized[9] and internationally shared standards can limit negative spillovers that product standards may have for exporters, particularly in developing countries. The WTO Agreement on Technical Barriers to Trade consequently emphasizes the need for the usage of

[6] A trade promoting effect is also identified in the *intra-industry hypothesis*, which states that internationally accepted standards promote intra-industry trade (Swann et al., 1996). However, we do not consider this hypothesis in our analysis since our interest solely lies in the export flows from SSA countries to the EU market and, thus precluding intra-industry trade.

[7] Standards are regarded as a NTB by UNCTAD (UNCTAD, 2012).

[8] The bearers are producers and exporters, for whom the costs can be significant.

[9] One can think of harmonization as "the establishment, recognition and application of common measures by different countries, where previously each might have had its own set of requirements." (WTO)

international standards, the assumption being that internationally aligned technical regulations and standards are not obstacles to international trade (The WTO Agreement on Technical Barriers to Trade).[10] The compliance to international standards should hence create a level playing field for all exporters (Czubala et al., 2009).

Standards and non-price competitiveness*: The competitive advantage hypothesis*

The *competitive advantage hypothesis* emphasizes a countervailing effect to the trade impact resulting from potentially high compliance costs to standards. Accordingly, the ability of firms to compete on global markets increases due to increased product quality through standard compliance (Fagerberg, 1988 and Stout & Swann, 1994) and this, in turn, leads to an increase of the confidence of foreign consumers in the domestic product, leading to increased export flow (Fontagné et al., 2005; Moenius, 2004 and Cipollina et al., 2016). Standards and standard compliance are a source of competitiveness with a trade promoting effect emerging from increased quality (Porter, 1990; Nelson, 1993 and Swann et al., 1996).

In this regard, Clougherty & Grajek (2009) further note that standardization leads to enhanced competitiveness of the firms due to internal efficiency gains and quality improvements. Moreover, minimum quality standards reduce transaction and search costs which positively affects exports and trade flows (Blind, 2004). Standards, furthermore, enable access to information for foreign firms regarding the necessary criteria to sell in a market. This information effect, by increased transparency on required criteria, leads to increased export opportunities for firms (Swann et al., 1996 and Clougherty & Grajek, 2009). The reduced information costs of standards, whether country-specific or shared, allow for easier contracting. Country-specific standards may, however, concurrently increase adaptation costs, as outlined by the competitive disadvantage hypothesis (Moenius, 2004).

Considering these opposing hypotheses, the net effect of standards on trade is ambiguous and subject to empirical analyses.

Empirical evidence on the effects of standards on trade

Empirical evidence on the impact of standards on trade is mixed and supports both the hypotheses outlined in the previous section. It furthermore becomes obvious that the effect of standards on trade depends on the kind of standards considered (e.g. international standards or country-specific standards). A common view in the literature is the assumption that international

[10] According to: https://www.wto.org/english/tratop_e/tbt_e/tbtagr_e.htm.

standards and bilaterally shared standards have a trade promoting effect, in contrast to national and country-specific standards which mainly act as NTBs (Swann et al., 1996).

Looking at the impact of foreign standards on firms' export performance for 619 firms in 17 developing countries, Chen et al. (2006) find that standards and technical regulations in developed countries have a significantly negative effect on developing countries' firms' propensity to export. The negative effects are mainly because of testing procedures and the differences in standards across foreign countries. Large adverse impacts were found for agricultural firms which produce highly perishable products. A negative impact is also shown by Otsuki et al. (2001), who analyze EU standards on aflatoxin and their impact on food exports from 9 African countries (between 1989-1998). They show that the (new) EU aflatoxin standard leads to a decrease of African exports by 64 percent. This negative effect is evident for the product groups cereals, dried fruits and nuts. Compared to an international standard by the Codex Alimentarius[11] guidelines, they conclude that the EU specific standards induce far greater trade impediments.

Other papers contrast the studies above (Moenius, 2004; Czubala et al., 2009 and Swann et al., 1996). Moenius (2004) finds that bilaterally shared standards have a trade promoting effect; Czubala et al. (2009) show that EU product standards harmonized with international standards restrict textile and clothing exports from Africa less than EU standards which are not harmonized with international ones. Finally, Swann et al. (1996) find that UK specific standards have a larger positive effect on UK trade flows than internationally equivalent standards. To reach his conclusion, Moenius (2004) uses panel data on both country-specific and international standards for 471 industries in 12 countries for the period of 1980-1995, and refers to the information costs as a possible explanation for these differing effects between country-specific and international standards. Czubala et al. (2009) emphasize the importance of international harmonization of product standards for developing countries' market access. They use the equivalence of standards to ISO standards as a proxy for international harmonization (in contrast to standards which are not equivalent to ISO standards). The relevance of ISO standards is also underlined by Clougherty & Grajek (2009), who analyze the impact of the ISO 9000 (Management Standards) standard on bilateral trade flows for 91 countries (for the period 1995-2005). Interestingly, they find that ISO certification promotes trade in developing countries which lack an institutional framework to detect quality-valuing firms.

The aforementioned findings of Swann et al. (1996) oppose the *competitive disadvantage hypothesis* regarding the trade-deterring effect of country-specific standards. However, there is an

[11] For food products, the Codex Alimentarius is the main international standards guideline in terms of product quality and food safety. It is published by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) (Otsuki et al., 2001).

important difference: the analyzed direction of trade. They consider UK-specific standards and their effects on the UK's trade, but country-specific standards are likely to have a different effect when viewed from the perspective of the exporter countries. Also Moenius (2004) demonstrates that standards can have opposing effects, depending on one's viewpoint. For country X, national standards have a positive and significant impact on exports and they have a negative and significant impact on imports. Exporters to country X thus experience standards as a hindrance to their trade with X, whereas country X experiences standards as a boost to their exports.

In line with the *competitive advantage hypothesis*, Cipollina et al. (2016) recognize the effect of information provision and increased transparency through standards. Looking at manufacturing sectors in 60 exporting countries and 57 importing countries, they show that quality standards increase the confidence of foreign consumers which results in a positive impact on trade flows. Even though standards might result in additional costs for exporters, they conclude that overcoming these financial constraints is crucial and compliance with foreign standards is essential for fostering trade. In this regard, Cipollina et al. (2016) put special emphasis on the role of innovation and the producer's ability to innovate and comply with the requirements for benefitting from standards.

To estimate the effect of product standards on firms' export decisions, Fernandes et al. (2017) use two novel datasets, the first covering all exporting firms in 42 developing countries and the second covering pesticide standards for 243 agricultural and food products in 80 importing countries over 2006–2012. Their analysis shows that product standards significantly affect foreign market access insofar as an increase in the stringency of standards in the destination country, relative to the exporting country, lowers firms' probability of exporting, deters exporters from entering new markets, and fosters exit from existing markets.

Finally, in a chapter on food safety standards and international trade, Keiichiro et al. (2015) conduct an extensive literature review of empirical studies using country-level data and those commonly using gravity models, and find that food safety standards generally have an adverse effect on trade.

Evidently, the empirical literature on the effects of standards on trade flows is mixed. The different kinds of standards considered play a crucial role for the effect of these standards on trade. Clougherty & Grajek (2009) and Maskus et al. (2000) emphasize the need of obtaining more empirical evidence in order to get quantitative implications of the impact of standards on countries' trade flows and trade prospects.

In our study, we seek additional evidence on the specific role of EU standards in North-South trade with a particular view on the effects for developing countries. We, therefore, assess the impact of EU standards on export flows of the main agricultural export products from SSA countries to the

EU. We additionally consider the role of the producers' '*ability to comply*' with international standards as critical determinant of export flows and of the effects of standards on export flows.

Hypotheses

Since the EC's "New Approach" (European Commission, 2017) means standards must be adopted by countries, as is, and harmonised to prevent internal technical barriers to trade, we expect these standards to have a trade promoting effect under the *competitive advantage hypothesis*. However, in light of the *competitive disadvantage hypothesis,* we also include the aspect of compliance costs by taking into account the SSA producers' '*ability to comply*' with international standards. The '*ability to comply*' refers to the current state of adherence to international standards and to the degree of business sophistication which enables firms to adequately respond to an introduction of standards. We expect the '*ability to comply*' with standards to have a positive impact on export flows from SSA countries to the EU. Moreover, we expect it will positively influence the impact of the introduction of standards in the EU on exports from SSA countries. Therefore, we hypothesize the following:

Hypothesis 1: The introduction of standards in the EU for the selected agricultural product groups positively affects the export flows from SSA countries to the EU.

Hypothesis 2: The export flows from SSA countries to the EU are significantly determined by the SSA producers' '*ability to comply*' with international standards.

Hypothesis 3: The producers' '*ability to comply*' with international standards positively influences the impact of standards on export flows from SSA countries to the EU, i.e. augmenting positive effects and mitigating negative effects.

Econometric modelling

Study design

Product selection

Our analysis focuses on agricultural goods, being apposite because they are subject to standard requirements and constitute a high share of SSA countries' exports to the rest of the world. Moreover, the EU is a major export market for SSA countries, importing 40% of SSA's agricultural exports (Spence, 2012). For our analysis, we select the four predominantly exported agricultural

product groups from SSA countries to the EU. These are (names as indicated at the HS 2 digit level[12]): (1) *Cocoa and cocoa preparations; (2) Edible fruit, nuts, peel of citrus; (3) Edible vegetables and certain roots* and (4) *Coffee, tea, mate and spices* (ITC, 2016).[13]

Standard selection

For a list of relevant EU standards for the selected agricultural products, we approached the British Standardization Institution (BSI)[14] because, as a member country of the International Organization for Standardization (ISO), the UK is obliged to adopt, as far as possible, international standards.[15] Of the 132 BSI standards (2 of which are amendments), 102 are equivalent to ISO standards and a further 41 are EN (European) standards.[16] Only 5 of the 132 standards are BSI (country) specific and, consequently, we regard our list of BSI standards as predominantly international. Additionally, thanks to the single market, goods compliant with UK legislation are eligible for exportation to mainland Europe.[17] The list of the 132 standards comprises these groups of standards and is highlighted in Appendix B.

Countries and time period

Within our analysis, we consider the export flows of the four selected agricultural product groups from the 39 Sub-Saharan African countries to 10 selected EU countries.[18] The EU countries are chosen because they routinely adopt the same standards as the BSI. While we do not have data for the remaining EU countries, the EC's "New Approach" (European Commission, 2017) means that standards approved by the European standardising body must be adopted by countries, as is, (see Vidal-León, 2016 – Appendix G) and harmonised to prevent internal technical barriers to trade in the

[12] The Harmonized Commodity and Coding Systems (HS) is a system for the international nomenclature for the classification of products (UN, 2017).

[13] The product group *Tobacco and manufactured tobacco substitutes* as well belongs to the predominantly exported product groups. Tobacco is, however, excluded from our analysis since we do not regard it as an agricultural product in the narrower sense, nor is tobacco identified by the European Commission (2016a) as a constituent of bulk exports to the EU.

[14] Data provided to the authors upon request to the British Standards Institute (David Priest, Information Specialist). Of the 132 BSI standards, only 5 are BSI specific, and the remaining 127 are either ISO and/or EN standards. Ideally this data would come from Perinorm, a database of international standards, but unfortunately we could not get access to this data.

[15] Exceptions are only allowed when the standard will be ineffective and inappropriate to fulfil its legitimate objective, for example, when there are differences in geography, climate or technology (The WTO Agreement on T*echnica*l Barriers to Trade), according to: https://www.wto.org/english/tratop_e/tbt_e/tbtagr_e.htm.

[16] A BSI standard can be equivalent to both an ISO and European standard.

[17] For a review of the legislation/standards applicable for these products to enter the single market see Appendix A.

[18] Tables 20 and 21 in Appendix F list the SSA and EU countries respectively.

EU (see Brits, 2016 – Appendix G).[19] Even though we consider our standards as European, our lack of data precludes us from including all 28 EU countries. Consequently, we restrict our analysis to the 10 EU countries for which we have data. Our analysis comprises data on the time period of 1980-2012.

Estimation strategies

For our regressions, we apply both an aggregate and a product specific approach. Within the aggregate estimation, our dependent variable is the aggregate of the export flows of all four agricultural product groups. This is related to the standard variables comprising a total of 38 standards (out of the initial 132 standards, 94 dropped out due to collinearity)[20] and the proxies as introduced in the model extension. Within the product-specific estimation approach, the dependent variable is the product-specific export flow from SSA countries to the EU (in US Dollars). This relates to the product-specific standard variables, which together comprise 42 standards (in that case out of the initial 132 standards, 90 dropped out due to collinearity). Among these 42 standards, the number of product-specific standards is: 1 for cocoa, 6 for fruits, 12 for vegetables and 23 for coffee. The proxies for the SSA producers' '*ability to comply*' with international standards included in the model extension do not change. Due to a lack of data, there is no product-specific differentiation possible for the included proxies.

General model specification

For our estimations, we use the gravity model of trade, which is the standard empirical framework for the assessment of determinants of trade flows. The gravity model predicts trade on a bilateral basis between any two countries. The name is derived from the similarity to Newton's universal law of gravity, with trade flows being proportional to the economic masses of the trading partners and inversely proportional to the distance between them, reflecting trade costs (Clougherty & Grajek, 2009; Hannan, 2016 and OECD & WTO, 2015).

We opt for a parsimonious model specification because many variables entering gravity-model specifications are imprecise. Egger & Pruša (2016) summarise the issues with the variables and note issues of measurement error, as well as specific responses per se, might lead to heterogeneous direct effects of trade impediments on trade flows, which are typically assumed to be the same. For the model specification, we follow the guidelines outlined by Piermartini & Yotov

[19] Interviews indicated expert perception of the relationship between standards and market access, additionally providing valuable insights that informed our research. For a summary of these interviews, please see Appendix G.

[20] Standards are commonly sold in bundles for goods and, hence, adopted together. For example, we have 10 parts to standard BS 5752, which relate to 'Methods of test for coffee and coffee products'. The adoption of bundles and/or standards together causes multicollinearity.

(2016)[21], which are supported by authors such as Baier & Bergstrand (2007), Head & Mayer (2013) and Anderson & Yotov (2016).

We apply a panel data analysis and assess the gravity model in a multiplicative form by applying a Poisson Pseudo Maximum Likelihood (PPML) estimation. The PPML estimator accounts for heteroscedasticity in the data and furthermore performs well even in the presence of zero trade flows (Piermartini & Yotov, 2016 and Santos Silva & Tenreyro, 2006).

We include three types of fixed effects in our analysis: country-pair fixed effects, importer-year and exporter-year fixed effects. As demonstrated by Baier & Bergstrand (2007), the advantage of employing country-pair fixed effects is their accounting for endogeneity of regional trade agreements, as well as for all time-invariant bilateral trade costs and other time-invariant co-variates, such as 'distance'[22],'colony' or 'cultural distance', which are commonly used as controls in gravity equations (Piermartini & Yotov, 2016). This is underlined by Egger & Nigai (2015) and Agnosteva et al. (2014), who show that the country-pair fixed effects capture more systematic information about trade costs than the standard gravity variables. Controlling for all bilateral trade costs is particularly important for our research, which seeks to characterize the role of standards for trade. The importer-year and exporter-year fixed effects take into account the multilateral resistance of the countries, i.e. the trade barriers each country faces with the rest of the other countries considered (Anderson & van Wincoop 2003 and Piermartini & Yotov, 2016). Moreover, the importer-year fixed effects capture the purchasing power and market size of the importing country, or the demand side effect of the commodity. The exporter-year fixed effects measure the supply side effect, which is an advantage over previous work applying the gravity equation to sectoral trade (Anderson & van Wincoop, 2003).

Robustness check

While our data consists of consecutive years, we follow Piermartini & Yotov (2016) and allow adjustments of trade flows as a robustness check by running estimations on interval data. For this purpose, we introduce intervals of 3 and 4 years in the trade data. This is applied since changes in trade flows do not happen instantaneously after a change in trade policies, or the introduction of a standard in our case (Piermartini & Yotov, 2016).

[21] According to Piermartini & Yotov (2016), we should: (i) Use panel data; (ii) Allow for adjustment in trade flows by using interval data instead of consecutive years; (iii) Include intra-national trade flows; (iv) Use directional (exporter and importer) time-varying fixed effects; (v) Employ pair fixed effects; and (vi) Estimate gravity in multiplicative form, i.e., with the Poisson estimator. We only meet five of these six best-practices since we do not have data on intra-national trade flows which they recommend to account for intra-national changes in trade.

[22] We omit distance from our preferred specification because of the country-pair fixed effects and, by explicitly excluding it, we gain several observations.

Two model implementations

We employ two models to account for our three hypotheses. First, a general baseline model controls for the impact of standards on export flows as expected in *Hypothesis 1.* Secondly, a model extension includes the aspect of the '*ability to comply*' with international standards, thereby accounting for the expected relationships as indicated in *Hypothesis 2* and *Hypothesis 3*. Data on export flows is obtained from the UN Comtrade database (UN, 2016).

Baseline model (Hypothesis 1)

Our specification of the baseline model (in linear form) is the following:

$$\begin{aligned} log Export\ Flows_{ijt} &= b_0 + b_1 log GDP_{ijt} + b_2 Standard_{ijt} + b_3 Standard\ total_{jt} \\ &+ b_4 Sum\ of\ Standards_t + u_{ijt} \end{aligned} \quad (1)$$

The subscripts *i*, *j* and *t* represent SSA countries, EU countries and the year, respectively. The variable '*Export Flows*' represents bilateral export flows from SSA countries to the EU. The '*GDP*' is the indicator for the economic masses of the trading partners and represents the averaged GDP of exporting and importing countries.[23] Distance is omitted from the specification because we include pairwise fixed effects. We include three different variables capturing the introduction of standards. The '*Standard*' variable is a dummy variable and takes the value 1 if a standard was in place in the respective EU countries in year t and is 0 otherwise. It contains one dummy for each standard, i.e. 38 single variables for the aggregate estimation and 42 for the product-specific estimation. The variable *'Standard total'* is equal to 1 for years in which at least one of the standards was adopted by any of the respective EU countries, and '*Sum of Standards'* shows how many of these standards were in place in a given year. It is defined as the count of the number of adopted standards.[24] Our error term is: $u_{ijt} = \gamma_{it} + \epsilon_{jt} + \omega_{ij} + \mu_{ijt}$, γ_{it} for the importer-time, γ_{it} and ϵ_{jt} for the importer-time and exporter-time respectfully, ω_{ij} for the pairwise fixed effects and μ_{ijt} the error term.

Model extension (Hypothesis 2 and Hypothesis 3)

In the second step, we extend the baseline model by including a proxy for the SSA producers' '*ability to comply'* with international standards, which we expect will impact export flows positively (addressed by Hypothesis 2). Since we also assume that this '*ability to comply'* impacts the effect of the introduction of standards on export flows (addressed by Hypothesis 3), we furthermore

[23] Aggregate GDP is used because Shepherd (2013) makes clear that it is aggregate GDP which should be used rather than population and per capita GDP as separate regressors.

[24] As used in several studies (DIN, 2011; The DTI Economics, 2005; Standards Council of Canada, 2007 and AFNOR, 2009, for example), the count of adopted standards is relevant.

include an interaction term between the '*ability to comply*' proxy and the '*Standard total*' variable. Our modified model is specified as follows, in which we include two sets of proxies:

$$\log Export\ Flows_{ijt} = b_0 + b_1 logGDP_{ijt} + b_2 Sum\ of\ Standards_t + b_3 Standard\ total_{\ jt} + b_4 logProxy_{ijt} + b_5 Standard\ total * Proxy_{ijt} + u_{ijt} \quad (2)$$

The first proxies take into account the SSA producers' adherence to ISO standards by looking at the number of issued ISO 9001 and ISO 14001 certificates in the SSA countries. These certify the adherence to international process standards addressing Quality Management Systems (ISO 9001) and Environmental Management Systems (ISO 14001). We assume that high numbers of these certificates in a SSA country are indicative for a relatively high '*ability to comply*' with international standards. In accordance with Hypothesis 2, this implies that a high number of ISO certificates in a country positively impacts export flows from SSA countries to the EU. Furthermore, in correspondence with Hypothesis 3, we assume a higher number of ISO certificates positively impacts the effect of the introduction of standards on export flows. Since companies already received ISO certificates for international process standards, they will be able to better adapt to newly introduced EU standards. We consider both the total number of issued certificates as well as the relative number as a share of population (in thousands) as an indicator of the diffusion of these certificates (following Clougherty & Grajek, 2009). Data is obtained from the ISO survey (ISO, 2016).

The second proxies comprise parameters of business sophistication since we assume a higher degree of business sophistication in a country facilitates the '*ability to comply*' with international standards. As parameters of business sophistication, we include the sectoral value added shares of agriculture, services and manufacturing (in % of GDP). Data is obtained from the World Bank (2016).

Empirical results

Baseline model (Hypothesis 1)

Aggregate estimation approach

Table 1 outlines the results for the baseline model applying the aggregate estimation approach. Interestingly, we see that the coefficient of the averaged GDP is insignificant and negative (-0.175).[25] Regarding the standards variables, we note that the adoption of any standard in a given

[25] This is a normal occurrence as Baltagi & Pinnoi (1995) demonstrate. The fixed effects estimate the short-run reaction between GDP and trade volume, which happens to be negative, whereas the long-run coefficient is positive (Kennedy, 2002). The negative coefficient for the averaged GDP thus results from a smaller long-run impact.

year ('*Standard total'*) leads to a significant reduction in aggregate export flows (-0.817). The count of standards in place ('*Sum of standards'*), however, has a significantly positive effect on aggregate export flows (0.112), but one insufficient to offset the reduction implied by the '*Standard total*' variable. Applying the separate estimation, the results for the single standards are categorised into: (a) positive and significant, (b) positive and insignificant, (c) negative and significant, and (d) negative and insignificant. We find that 14 of the 38 standards[26] (36.8%) have a positive and significant impact on trade volume, and 18 (47.4%) have a negative and significant impact. There are additional 6 standards that have a negative but insignificant impact (see Appendix C, Table 6, column (1) for the detailed results). These results outline a dual impact of the single '*Standard*' variables on export flows, and are confirmed by the robustness check (see Appendix C, Table 6, columns (2) and (3)). Interestingly, when applying 3-year interval data for the robustness check (see Appendix C, Table 6, column (2)), both the '*Sum of Standards*' variable and in this case also the '*Standard total*' variable reveals a significantly positive coefficient. This strengthens the indication for the existence of a positive impact of standards on agricultural export flows from SSA to the EU. Looking at the results for the separate estimations of each standard, the robustness check of the 3 year interval data reveals both significantly positive (2 out of 18 = 11%) and significantly negative (8 out of 18 = 44.4%) results. The remaining standards have both insignificantly positive and negative impacts. The 4-year interval data (Appendix C, Table 6, Column (3)) is less conclusive. The results of the aggregate estimation approach are only in part indicative for Hypothesis 1.

[26] Out of the initial 132 standards, 94 standards are dropped from the specification because of collinearity (see Estimation strategies).

Table 1: Effect of GDP and Standard variables on export flows from SSA countries to the EU (consideration of aggregated export flows of cocoa, coffee, fruits and vegetables)*

Dependent variable: log Export Flows (1980-2012)		
	Aggregated product groups	***Indication for Hypothesis 1***
log GDP	-0.175	
	(0.277)	
"Standard total"	-0.817*	--
	(0.454)	
"Sum of Standards"	0.112**	+
	(0.045)	
Separate evaluation of the 38 standards, matching the coefficients according to sign and significance*		
+ve & significant	14	+ / --
+ve & insignificant	0	
-ve & significant	18	
-ve & insignificant	6	
No. of standards	38	
R-squared	0.894	
FE (i, j, t)	ij, it, jt	

Notes: Results presented are for PPML model of export flows on standard dummies, standard total dummy and sum of standards. "*Standard*" dummies are equal to unity for years in which the standard was adopted by the respective EU country, "*Standard total*" is equal to unity for years in which at least 1 standard was adopted by the respective EU country, and "*Sum of standards*" is defined as the count of the number of adopted standards in a particular year. The data are annual, comprising up to 2824 observations for 94 trade pairs among 49 countries (39 exporters and 10 importers) over the 1980-2012 time horizon. Fixed effects are included as indicated but not reported: *ij* – country-pair fixed effects; *it* – importer ('directional')-time fixed effects; *jt* – exporter ('directional')-time fixed effects. White heteroscedasticity-robust standard errors reported in parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.
* Compilation of results, for details see Appendix C, Table 6, column (1).

Product group specific estimation approach

Subsequently, we run the model specification differentiated by each product group: (1) Cocoa and cocoa preparations ('cocoa'), (2) Edible fruits, nuts, peel of citrus ('fruit') (3) Edible vegetables and certain roots ('vegetables') and (4) Coffee, tea, mate and spices ('coffee'). With less collinearity among the standards dummies, these regressions yield slightly more revealing results and insights into the effect of standards. A compilation of essential results on the product-specific estimation of the effects of standards on export flows is outlined in Table 2 (detailed results and results for the robustness check are provided in Appendix C, Tables 7-10). Table 2 shows that the '*GDP*' coefficient remains insignificant for all the product groups. The '*Standard total*' variable only

reveals results for the coffee sector, which is however insignificant (1.830); for the groups cocoa, fruits and vegetables, the coefficients are not determined because, in each case, the dummy was excluded from the respective regression to ensure that the estimates exist. The '*Sum of standards*' reveals a significantly positive impact on export flows of the product groups cocoa (0.316) and fruit (0.490). Interestingly, when considering the results for the effects of the single standards separately, we find both positively significant and negatively significant standards for the product groups 'fruit' and 'coffee'. Significant standard variables of the 'vegetables' product group reveal a negative sign. For cocoa, an assertion is limited: We find no significant impact of the standard on export flows (only one standard is cocoa-specific, however). Nevertheless, results emphasize the findings in the aggregate estimations, that standards have both positive and negative effects on export flows.

Looking at the robustness check the 3-year interval data of the product group specific estimation (Appendix C, Tables 7-10, Column (2)) show an insignificant GDP coefficient for all product groups (positive for cocoa, negative for fruits, vegetables and coffee). Additionally, the *'Standard total'* variable reveals a significant result only for the coffee sector, which is significantly negative (-0.984), whereas the results for '*Sum of Standards'* are significantly negative for cocoa (-0.620) and insignificant for the other sectors (positive for fruits, negative for vegetables and coffee). When considering the effects of the single standards for each product group separately, the 3-year interval data show both significantly positive and significantly negative effects only for the product group coffee. In the 4-year interval data the "*Standard total*" variable is significantly positive (1.084) for the product group coffee. For the product group coffee "*Sum of Standards*" is significantly negative (-0.085), whereas "*Sum of Standards*" yields insignificant results for the product groups cocoa, fruits and vegetables. Also in the product specific approach, Hypothesis 1 can only be in part confirmed.

Table 2: Effect of GDP and Standard variables on product-specific export flows from SSA countries to the EU for the product groups of cocoa, coffee, fruits and vegetables*

	Dependent variable: log Export Flows (1980-2012)							
	Cocoa	***Indication H1***	**Fruit**	***Indication H1***	**Vegetables**	***Indication H1***	**Coffee**	***Indication H1***
log GDP	-0.431 (0.000)		-0.509 (0.421)		0.430 (0.464)		-0.397 (0.349)	
"Standard total"	- (a)		- (a)		- (a)		1.830 (-1.408)	
"Sum of Standards"	0.316** (0.000)	+	0.490** (-0.236)	+	0.189 (-0.359)		0.077 (-0.086)	
Separate evaluation of the 38 standards, matching the coefficients according to sign and significance								
+ve & significant	-	-	2	+ / --	-	/ --	5	+ / --
+ve & insignificant	-		1		4		4	
-ve & significant	-		2		4		6	
-ve & insignificant	1		1		4		8	
No. of standards	1		6		12		23	
R-squared	0.939		0.872		0.890		0.894	
FE (i, j, t)	ij, it, jt		ij, it, jt		ij, it, jt		ij, it, jt	

Notes: See additional notes under Table 1.
* Compilation of results, for details see Appendix C, Tables 7-10.
(a) The coefficient for 'Standard total' is not determined because the dummy was excluded from the regression to ensure that the estimates exist.

Model extension (Hypothesis 2 and 3)

To extend the model, we integrate the '*Proxy*' for the SSA countries' '*ability to comply*' with international standards and an interaction term between the '*Proxy*' and the '*Standard total*' variable (see equation 2). Applying the two sets of proxies results in seven model specifications with the following parameters for the first set of proxies (adherence to ISO standards): (1) total number of ISO 9001 certificates, (2) relative number of ISO 9001 certificates to population, (3) total number of ISO 14001 certificates, (4) relative number of ISO 14001 certificates to population and the following parameters for the second set of proxies (parameters of business sophistication): (5) Agricultural value added (in% of GDP) , (6) Services value added (in % of GDP) and (7) Manufacturing value added (in % of GDP).

Aggregate estimation approach

Table 3 shows the results for the seven model specifications including the afore-mentioned different "Proxy" variables for the SSA producers' '*ability to comply'* with international standards. In line with the results for the baseline model, in the aggregate approach, the '*GDP*' estimator remains insignificant and partly negative (model specifications 6 and 7). The significant negative effect of the '*Standard total'* variable is only evident when applying the absolute number of ISO 14001 (model specification 3; -0.036) and relative number of issued ISO 14001 certificates (model specifications 4; -0.033) as well as for the value-added share of manufacturing (model specification 7; -0.100). The positive impact of the '*Sum of standards*' variable on export flows from SSA countries to the EU is evident for all seven model specifications, with significant values between 0.001 and 0.002. Also included in Table 3 are the results for the '*Proxy*' variable indicating the impact of the '*ability to comply*' on export flows from SSA countries to the EU. In contrast to our expectation, the '*Proxy*' variable only shows a significantly positive impact on export flows when applying the absolute number of ISO 14001 certificates as a proxy (model specification 3; 0.015). In the other model specifications, the coefficients are insignificant. The positive impact of the 'Proxy' variable on export flows is confirmed by the robustness tests for the absolute number of ISO 9001 certificates (4-year interval data), the relative number of ISO 9001 certificates (3-year interval data) and the absolute and relative numbers of ISO 14001 certificates (4-year interval data) (Appendix E, Table 15). Hence, Hypothesis 2 is only supported in the case of model specification 3 (absolute number of ISO 14001 certificates).

Moreover, regarding the expected positive interaction between the '*Proxy*' variable and the '*Standard total*' variable, the results contrast our expectation. In the aggregate estimation, there exists an interaction between the two variables only in two of the model specifications (specifications 1 and 2), the effect of these interactions is however significantly negative (-0.013, resp. -0.010) (Table 3). The few significant interactions between the '*Proxy'* variable and the '*Standard total'* variable are confirmed by the robustness checks in one case (see Appendix E, Table 15), when applying the absolute number of ISO 9001 certificates (for 4-year interval data), along with a negative interaction (-0.023). In the robustness check, the GDP coefficient is insignificant for the 3-year interval data in all model specifications. In the 4-year interval data it is insignificant for the specifications 5-7, but it is positively significant for the specifications 1-4.

Table 3: Effect of '*Proxy'* for '*ability to comply'* with international standards and interaction term on export flows from SSA countries to the EU - consideration of aggregated export flows of cocoa, coffee, fruits and vegetables

	Dependent variable: log Export Flows (1980-2012)						
	Adherence to ISO standards				**Parameters business sophistication**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
	ISO9001 (abs)	**ISO9001/ Pop**	**ISO14001 (abs)**	**ISO14001/ Pop**	**Value added share (in % of GDP) of Agriculture**	**Services**	**Manufacturing**
log GDP	0.001	0.000	0.001	0.001	0.001	-0.001	-0.000
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
"Standard total"	-0.002	-0.005	-0.036*	-0.033*	-0.037	-0.031	-0.100*
	(0.025)	(0.022)	(0.021)	(0.017)	(0.030)	(0.072)	(0.054)
"Sum of Standards"	0.002***	0.002***	0.001***	0.001***	0.002***	0.002***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
"Proxy"	0.010	0.007	0.015*	0.004	-0.006	-0.011	-0.015
	(0.008)	(0.005)	(0.008)	(0.004)	(0.006)	(0.012)	(0.010)
Interaction	-0.013*	-0.010**	-0.004	-0.002	0.002	0.001	0.012
	(0.008)	(0.005)	(0.007)	(0.004)	(0.005)	(0.012)	(0.010)
Constant	2.578***	2.204***	3.369***	3.369***	3.392***	2.613***	2.245***
	(0.034)	(0.043)	(0.038)	(0.035)	(0.048)	(0.077)	(0.057)
Observations	2,825	2,825	2,825	2,825	2,825	2,825	2,825
R-squared	0.817	0.817	0.818	0.817	0.817	0.817	0.817
FE (i, j, t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

Notes: Results presented are for PPML model of exports flows on standard total dummy, sum of standards, proxies and an interaction term. The proxy is for the SSA countries' '*ability to comply'* with international standards and the interaction term is between the proxy and the '*Standard total'.* See additional notes under Table 1.

Product-specific estimation approach

Results from the aggregate estimation become more distinct when considering the product-specific estimation. In the product specific approach, the GDP estimator remains insignificant for the product groups cocoa, fruits and vegetables (Appendix D, Tables 11-13). An exception is the product group coffee which reveals a significantly positive GDP estimator (Appendix D, Table 14). Table 4 and Table 5 show a compilation of the main results of the product-specific estimation for the impact of the '*Proxy*' variables on export flows (Table 4) and the results of the interaction effect (Table 5) (for total of results, see Appendix D, Tables 11-14). Table 4 outlines the results for the *'Proxy'* variable for each product group and each proxy specification. The first set of proxies, which are addressing the

adherence to ISO standards, yields significant results in 10 cases. Importantly, in 9 out of the 10 cases the impact of the analysed ISO certificates on export flows from SSA countries to the EU is significantly positive. Interestingly, the relative number of ISO 14001 certificates (to population) yields significantly positive effects for all four product groups, ranging between 0.039 and 0.093. The absolute number of ISO 14001 certificates impacts export flows significantly and positively for the product groups fruits (0.369), vegetables (0.142) and coffee (0.058). ISO 9001 certificates yield significantly positive results for the product groups fruits (0.056, for the absolute number) and coffee (0.080, for the relative number). These results suggest that a higher (absolute and relative) number of ISO 14001 and (to a lesser extent) ISO 9001 certificates in the SSA countries positively impact export flows to the EU, which supports Hypothesis 2. When considering the second set of proxies, however, the results are more mixed. Out of the 8 cases where the '*Proxy*' variable yields significant coefficients, 4 coefficients are positive. This is the case for value added agriculture, which has a significantly positive effect on export flows for the product groups of vegetables (0.076) and coffee (0.069). Value added manufacturing yields significantly positive effects on export flows for the product groups of fruits (0.074) and vegetables (0.052).

The positive impact of the "*Proxy*" variable on export flows can also be seen in the results of the robustness tests (see in Appendix E, Tables 16-19). This is specifically evident for the 3-year interval estimation which shows a strong positive impact of the "*Proxy*" variable on export flows of the products cocoa and fruits (Appendix E, Tables 16 and 17) and in part of vegetables (Appendix E, Table 18). This is confirmed also by the 4-year interval data by significant positive results for fruits, coffee and cocoa (Appendix E, Tables 16, 17 and 19).

Table 4: Effect of '*Proxy*' for '*ability to comply*' with international standards on product-specific export flows from SSA countries to the EU for the product groups of cocoa, coffee, fruits and vegetables*

	Dependent variable: log Export Flows (1980-2012)						
	Adherence to ISO standards				**Parameters business sophistication**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
	ISO9001	**ISO9001/**	**ISO14001**	**ISO14001/**	**Value added share (in % of GDP) of**		
Product groups	**(abs)**	**Pop**	**(abs)**	**Pop**	**Agriculture**	**Services**	**Manufacturing**
Cocoa	-0.068*** (0.015)	n.s.	n.s.	0.092*** (0.008)	n.s.	n.s.	n.s.
Fruits	0.056** (0.026)	n.s.	0.369*** (0.084)	0.093*** (0.029)	-0.124*** (0.013)	n.s.	0.074*** (0.028)
Vegetables	n.s.	n.s.	0.142*** (0.029)	0.081*** (0.021)	0.076*** (0.022)	-0.144*** (0.015)	0.052*** (0.014)
Coffee	n.s.	0.080*** (0.013)	0.058*** (0.016)	0.039** (0.017)	0.069*** (0.019)	-0.076** (0.009)	-0.026* (0.015)

Notes: Statistical significance: *** p<0.01, ** p<0.05, * p<0.1
n.s.: not significant
* Compilation of results, for details see Appendix D, Tables 11-14.

An identifiable interaction exists between the '*Proxy*' of the ability to comply with international standards and the '*Standard total*' variable. Table 5 shows a compilation of the results for the interaction term for each product group and each proxy specification (see Appendix D, Tables 11-14 for total of results). The results for the '*Standard total*' variable is also outlined in Table 5. When looking at the first set of proxies on the adherence to ISO standards, the interaction term is significant in 5 cases (for the product group fruits when applying model specifications 3 and 4, and for the product group coffee when applying model specifications 1, 3 and 4). The effect is, however, significantly negative in all the 5 cases, which is against our expectation outlined in Hypothesis 3. The results of the second set of proxies capturing the degree of business sophistication yield one significant interaction effect. This is the case for the product group vegetables and the model specification 7 (value added manufacturing). The interaction effect is significantly positive (0.044), which is in line with our expectation in Hypothesis 3. Together with the significantly negative coefficient of the '*Standard total*' variable in this model specification (-0.459), this suggests the following: The higher the value-added share of manufacturing in the SSA countries is, the smaller is the negative impact of an introduction of a standard addressing the vegetable sector on the export flows of vegetables from SSA countries to the EU. This implies that high value added shares in manufacturing mitigate negative effects on export flows when the EU introduces a standard.

This result is amplified by the robustness tests (see Appendix E, Tables 16-19), which reveal 8 cases with a significantly positive interaction term. When applying the 3-year interval data, we find a positive interaction for three of the four product groups. For cocoa (Appendix E, Table 16), for higher relative numbers of ISO 9001 certificates and a higher value-added share of services, we find a mitigation of the negative effect on export flows when introducing a standard. For fruits (Appendix E, Table 17), we find a significantly positive interaction for the proxies ISO 9001 and ISO 9001 / population. Since the coefficient of the 'Standard total' variable is insignificant, this suggests that there only is a positive effect on export flows in cases where a standard is introduced and high absolute and relative numbers of ISO 9001 certificates exist in the SSA countries. In the case of vegetables, we also find both a mitigation of a negative and a promotion of a positive effect (Appendix E, Table 18). While a high absolute number of ISO 14001 certificates promotes the positive effect of a standard introduction, a high relative number of ISO 14001 certificates (to population) mitigates a negative effect. Additionally, in the case of value added manufacturing, the coefficient of the interaction term is significantly positive.[27] When applying 4-year interval data, we find a mitigating negative effect of a standard introduction for coffee for higher value added shares in the services sector (Appendix E, Table 19). For the other product groups, no significantly positive interaction terms were identifiable when the 4 year-interval data is applied. On the other hand, it must be taken into account that significantly negative results become obvious in part for cocoa, fruit and coffee in the 3-year interval data and for fruits and coffee in the 4-year interval data.

[27] In this case, results for the '*Standard total*' variable could not be determined, because the dummy is excluded from the regression to ensure that the estimates exist.

Table 5: Results for the interaction term between the 'Proxy' for the ability to comply with international standards and the BSI standard for the product groups of cocoa, coffee, fruits and vegetables*

		Dependent variable: log Export Flows (1980-2012)						
		Adherence to ISO standards				Parameters business sophistication		
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
		ISO9001	ISO9001/	ISO14001	ISO14001/	Value added share (in % of GDP) of		
Product groups		**(abs)**	**Pop**	**(abs)**	**Pop**	**Agriculture**	**Services**	**Manufacturing**
	"Standard total"							
Cocoa								
	Interaction effect	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
	"Standard total"			-0.195	-0.447***			
Fruits				(0.137)	(0.117)			
	Interaction effect	n.s.	n.s.	-0.230***	-0.077***	n.s.	n.s.	n.s.
				(0.082)	(0.027)			
	"Standard total"							-0.459*
Vegetables								(0.245)
	Interaction effect	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0.044**
								(0.017)
	"Standard total"	-0.082		-0.005	0.892***			
Coffee		(0.123)		(0.036)	(0.058)			
	Interaction effect	-0.008*	n.s.	-0.030***	-0.009**	n.s.	n.s.	n.s.
		(0.004)		(0.007)	(0.004)			

Notes: Compilation of results for the interaction term. See Appendix D, Tables 11-14 for total of results. The interaction term is composed of the '*Proxy*' of the ability to comply with international standards and the '*Standard total*' variable, which is equal to unity for years in which at least 1 standard was adopted by the respective EU country.
Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.
n.s.: not significant
* Compilation of results, for details see Appendix D, Tables 11-14.

Limitations

Assessing the impact of standards on trade is faced with special challenges because the interrelation between standards and trade reveals intrinsic dynamics. The empirical literature denotes two problems: the problem of endogeneity and the problem of simultaneity. The problem of endogeneity means that there might be a promotion of trade because of a harmonization of standards and the decreased trade barriers but, in turn, the standardization process might also be influenced by the intensity of trade relations (Clougherty & Grajek, 2009). Moenius (2004) finds evidence for this two-way causality between standards and trade volumes but using a panel data approach with fixed effects adjusts well for endogeneity (Baier & Bergstrand, 2007; Head & Mayer, 2013 and Anderson & Yotov, 2016). Additionally, the simultaneity problem must be considered, which implies that more standards will be produced in areas where trade performance is strong

(Swann et al., 1996,). While this may be true, the two do not occur simultaneously because there is an inherent lag in the process of the introduction and implementation of standards. There is a time lag between the recognition of the need for a certain standard, its development and the actual implementation of the standard. For example, the BSI states that development of a British Standard takes between one and four years, depending on the complexity of the subject and the range of stakeholders involved. For this reason, too, international standards usually take longer to develop than country-specific standards. Changes in trade volume might hence already occur in advance because the information on standards – and their development – is public information (representatives of industry bodies, research and testing organizations, local and central government, consumers and standards users are part of the technical committees who draw up standards), or only after a certain time lag after the standard introduction (The British Standards Institution, 2017).

Discussion

The impact of standards on export flows

Scrutinizing the effect of international standards on agricultural export flows from SSA countries to the EU, we focus on the four agricultural product groups predominantly exported from the SSA countries to the EU. These are: cocoa, fruits, vegetables and coffee. We carry out our analysis by first applying an aggregate estimation of the four product groups and secondly, by applying a product-specific estimation for each group separately. The results contribute to the empirical evidence concerning the question of how standards impact trade.

Our analysis highlights the definite impact of standards on export flows of the selected agricultural products from SSA countries to the EU. The concrete manifestation of that impact is twofold, and this impact becomes generally more distinct when applying the aggregate estimation. In the aggregate estimation, the introduction of any standard in a given year ('*Standard total*') leads to a significant reduction in export flows, whereas the count of standards in place in the EU in a particular year (*'Sum of standards'*) has a significantly positive effect on export flows. Moreover, the impact of the single standards has both significantly positive and significantly negative effects. In the product-specific estimation, significant positive results become evident under fruits and under cocoa (for consecutive years) for "*Sum of standards*". When assessing the impact of the product-specific single standards both significantly positive and significantly negative effects become evident (for fruit and coffee). For vegetables, only significantly negative results are observable. For cocoa the result is insignificant (only one standard assessed).

These differing impacts demonstrate that standards act both as barrier and catalyst to trade. The standards we consider are predominantly shared among the EU, so our results seem to contradict the assumption that international standards and bilaterally shared standards inherently have a trade promoting effect. To make a more definitive conclusion regarding the impact of international and particularly bilaterally shared standards, requires data on standards which are already in place in the SSA countries (potential of compliance), but this was unobtainable. This may be something future work can address.

Our finding of the positive effect of the count of the standards ('*Sum of standards*') is in line with several national studies (DIN, 2011; The DTI Economics, 2005; Standards Council of Canada, 2007; AFNOR, 2009; Stokes et al., 2011 and Centre for International Economics, 2006). This reinforces the belief that standards have a positive effect on trade flows. Based on the difference of our results ("*Standard total*" / "*Sum of standards*") and the differing signs of impacts of the single standard variables, our results are indicative for our Hypothesis 1 in part only ("*The introduction of the BSI standards in the EU for the selected agricultural product groups affects the export flows from SSA countries to the EU positively*.") Within our list of standards, we sought patterns regarding which types of standards have positive effects, and which have negative effects but no discernible patterns were identifiable.

The role of the '*ability to comply*' with international standards

Regarding the general role of the '*ability to comply*' with international standards, which we capture by two sets of proxies (adherence to ISO standards and the parameters of business sophistication), our analysis showed that this is a determining factor of agricultural exports of SSA countries to the EU. Analyzing the effect of the '*Proxy*' variables on export flows, both significantly positive and significantly negative effects become obvious. However, the significantly positive effects prevail, which is distinct in the product-specific estimation. The adherence to ISO standards (ISO 9001 and ISO 14001 specifically) yields positive effects on export flows in 9 out 10 significant cases. This, therefore, suggests that a higher number of these ISO certificates in SSA countries strengthens the potential of agricultural exports from SSA countries to the EU. For the degree of business sophistication, this positive effect is obvious in 4 out of 8 significant results and becomes obvious for value added agriculture (for the product groups of vegetables and coffee) and value added manufacturing (for the product groups of fruits and vegetables). Together, these findings are indicative of Hypothesis 2 ("*The export flows from SSA countries to the EU are significantly determined by the SSA producers' ability to comply with international standards.").*

These results emphasize the need for fostering business development, both with regard to the adherence to international processing standards (as captured by the ISO certificates) as well as to business sophistication. Strengthening the potential of compliance will, in turn, result in generally trade promoting effects for SSA countries. Concerning the degree to which this '*ability to comply*' also impacts the effects of the introduction of BSI standards on export flows from SSA countries to the EU (interaction effect between '*Proxy*' variables and '*Standard total*'), our analysis shows mixed results. There are only a few cases where an interaction exists, which reveal both positive and negative effects. The expected positive influence of the '*Proxy*' variables on the effect of standards on export flows becomes obvious in only one case. In this case, we find a positive impact of value added manufacturing on the negative effect of standards on vegetables export flows from SSA countries to the EU. This mitigation of the negative effect is indicative of Hypothesis 3 ("*The producers' ability to comply with international standards is positively influencing the impact of BSI standards on export flows from SSA countries to the EU, i.e. augmenting positive effects and mitigating negative effects.").* We find further support for Hypothesis 3 in the results of our robustness tests, which imply a mitigation of the negative effect of standards introduction for certain 'Proxy' variables for cocoa (for the proxies ISO9001/population and value added share in services) and vegetables (for the proxy ISO 14001/population) (3-year interval data) and coffee (for the proxy value added share in services) (4-year interval data). Moreover, for the fruits sector, the results of the robustness tests show a positive interaction between the ISO 9001 proxies (absolute and relative to population) and the introduction of a standard (3-year interval data). The results imply that ISO 9001 certificates lead to a significantly positive effect of standards introduction on export flows, which is otherwise insignificant. For the vegetables sector (3-year interval data), the results show a positive interaction for the ISO14001 proxy, which even further promotes the initial significantly positive effect of a standard introduction on export flows.

For deeper insights into the relationship between the '*Proxy*' variables for the '*ability to comply*', and the effect of standards on export flows, including a broader spectrum of proxies to capture the SSA producers' '*ability to comply*', would be helpful. Information on the state of the SSA producers' compliance with international standards or the SSA's bilaterally shared standards with the EU could give additional information on the already existing degree of compliance with international standards in the SSA countries, as determining factor the impact of standards. Furthermore, a diversified analysis of product-specific value chains and their particular standard requirements could give detailed insights into the role of the '*ability to comply'* and the effects of standards on export flows. However, we do not have access to the data on standard compliance for SSA.

Conclusion

Our results show that over and above simple market access, standards matter for SSA countries. SSA countries are generally small, with segmented markets and constrained access to the sea. Non-compliance with international standards deprives African producers' access to key international markets and probably leads to a reduction in global market share – especially in agricultural products. Therefore, without addressing challenges of market access and international standards compliance issues, African firms and farmers will be unable to take full advantage of recent market opening initiatives such as the EU's Everything But Arms initiative (Wilson & Abiola, 2003). SSA countries will not have access to the single market if the common minimum standards of the EU are not met.

Fostering the degree of standard compliance by strengthening the producers' '*ability to comply*' with international standards is of specific importance for the agricultural sector in the SSA countries. Agriculture continues to play a pivotal role in Africa and has a considerable developmental impact because 65% of the SSA region's employment[28] is related to agriculture, agricultural trade and agro-industry (World Economic Forum et al., 2015 and World Bank, 2016). Therefore, SSA's path out of poverty and food insecurity remains agriculture-based (World Economic Forum et al., 2011; GIZ, 2012 and World Bank, 2016). Securing new and diversified agricultural markets that consolidate and increase SSA's trade position in agricultural products will have a direct impact on the incomes of many Africans, improving their poverty situation (Nyangito et al., 2003). Furthermore, Kym Anderson emphasizes the need for more open agricultural trade policies to improve self-sufficiency and enhance food security (Goodwin, 2017).

Therefore, capacity development of SSA countries to meet international standards is a crucial determinant of economic development (Nyangito, 2003). The decisive challenge hereby is the costly process of standard compliance. This challenge stands out and is crucial for the agricultural sector, in which smallholder farmers supply up to 80% of the food in SSA (World Economic Forum et al., 2015). In order to foster the compliance capacity, farmers need to be provided with appropriate financing schemes in order to make necessary investments and meet required standards for integration in value chains. Enforcing domestic business development and sophistication are important steps towards building up the '*ability to comply*' with international standards necessary to be integrated into world trade. However, it must be taken into consideration that meeting the standards required for participating in world trade and integrating into global value chains will be a

[28] Staple food crops account for about half of the employment in SSA, with 47% of these workers being women (World Economic Forum et al., 2015 and World Bank, 2016).

gradual process for Africa's agriculture exporters. In the interim, gains can be made from integrating into regional value chains (World Economic Forum et al., 2011 and GIZ, 2012).

To better understand the impact of international standards on agricultural trade of SSA countries, further research is necessary. A starting point could be additional differentiation of the effects of international, country-specific and bilaterally shared standards but this is currently limited by an insufficient availability of data. Moreover, extensions to our work could include the relevance of the ability to comply with international standards, which can add to our understanding of the general preconditions needed to reap the benefits from international standards and world trade. In this regard also, the consideration of the institutional quality within the exporting countries is of interest.

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Appendix A: European legislation applicable to SSA exports

Having identified, in the previous sections, the major SSA agricultural exports to Europe, we now review the legislation applicable for these products to enter the single market. The legislation was received via email from the European Commission's DG Agriculture and Rural Development, with further assistance from the Commission's EU-WTO-TBT Enquiry Point.

- Directive 2000/36/EC[29] relates to cocoa and chocolate products intended for human consumption.[30] The Directive references standards, insofar as it states "For the purposes of taking into account technical progress and developments in relevant international standards…". But it does not mention any particular international standards with which the cocoa and chocolate products must comply. Nonetheless, this Directive is very specific with regards to sales names, definitions and characteristics of the products. The simplest example is that of *Fat-reduced cocoa, fat-reduced cocoa powder* which, under the Directive, is cocoa powder containing less than 20% cocoa butter, calculated according to the weight of the dry matter.
- Directive 1999/4/EC[31] relates to coffee and chicory extracts. This Directive merely mentions that Member States shall ensure the methods used to determine the free and total carbohydrate content of soluble coffees are validated or standardised, either already or as soon as possible.
- EC No 1234/2007 in respect of the fruit and vegetables and processed fruit and vegetables sectors[32], the Directive includes particular marketing standards but only insofar as products need to meet the minimum requirements. There is no mention of a particular international standard, only such things as the (general) minimum quality requirements which includes, amongst others, that the products shall be: Intact; clean, practically free from any visible foreign matter; practically free from pests and free of any foreign smell and/or taste. The Directive also specifies a tolerance of 10% by number or weight of product not satisfying the minimum quality requirements that shall be permitted in each lot. Further, within this tolerance, not more than 2% in total may consist of produce affected by decay.

[29] Council Regulation (European Commission).
[30] The Official Journal of the European Union (OJ) Legislation 197, 3.8.2000, p.19.
[31] The Official Journal of the European Union (OJ) Legislation 066, 13.3.1999, p.26
[32] The Official Journal of the European Union (OJ) Legislation 157, 15.6.2011, p.1

- Regulation (EU) No 1169/2011[33] relates to general EU rules regarding the provision of food information to consumers**.** Once again it only mentions minimum standards but no specific international standards.

Appendix B: Initial set of 132 agricultural British Standardization Institution (BSI) standards[34]

Standard code	Document identifier	Title
Std001**	BS ISO 855:2003	Oil of lemon [Citrus limon (L.) Burm. f.], obtained by expression
Std002**	BS ISO 3053:2004	Oil of grapefruit (Citrus x paradisi Macfad.), obtained by expression
Std003	BS ISO 3064:2015	Essential oil of petitgrain, Paraguayan type (L. var. Paraguay (synim var. bigaradia Hook f.))
Std004***	BS ISO 3140:2011	Oil of sweet orange [Citrus sinensis (L.) Osbeck], obtained by physical extraction of the peel
Std005***	BS ISO 3517:2012	Essential oil of neroli (Citrus aurantium L., syn. Citrus amara Link, syn. Citrus bigaradia Loisel, syn. Citrus vulgaris Risso)
Std006	BS ISO 3519:2005	Oil of lime distilled, Mexican type [Citrus aurantifolia (Christm.) Swingle]
Std007*	BS ISO 3525:2008	Oil of amyris (Amyris balsamifera L.)
Std008	BS ISO 3528:2012	Essential oil of mandarin, Italian type (Citrus reticulata Blanco)
Std009	BS ISO 3809:2004	Oil of lime (cold pressed), Mexican type [Citrus aurantifolia (Christm.) Swingle], obtained by mechanical means
Std010	BS ISO 8899:2003	Oil of lemon petitgrain [Citrus limon (L.) Burm.f.]
Std011	BS ISO 8900:2005	Oil of bergamot petitgrain [Citrus bergamia (Risso et Poit.)]
Std012***	BS ISO 9844:2006	Oil of bitter orange (Citrus aurantium L.)
Std013***	BS ISO 23954:2009	Oil of lime expressed, Persian type (Citrus latifolia Tanaka)
Std014***	BS EN 12148:1997	Fruit and vegetable juices. Determination of hesperidin and naringin in citrus juices. Method using high performance liquid chromatography
Std015	BS 684-1.13:1976	Methods of analysis of fats and fatty oils. Physical methods. Determination of cooling curve
Std016	BS ISO 2451:2014	Cocoa beans. Specification
Std017***	BS ISO 11053:2009	Vegetable fats and oils. Determination of cocoa butter equivalents in milk chocolate
Std018**	BS EN ISO 23275-1:2008	Animal and vegetable fats and oils. Cocoa butter equivalents in cocoa butter and plain chocolate. Determination of the presence of cocoa butter equivalents
Std019	BS EN ISO 23275-2:2008	Animal and vegetable fats and oils. Cocoa butter equivalents in cocoa butter and plain chocolate. Quantification of cocoa butter equivalents
Std020	BS 5752-2:1984*ISO 1447-1978	Methods of test for coffee and coffee products. Green coffee: determination of moisture content (routine method)
Std021	BS 5752-3:1983*ISO 4052-1983	Methods of test for coffee and coffee products. Coffee: determination of caffeine content (reference method)

[33] The Official Journal of the European Union (OJ) 304, 22.11.2011, p.18

[34] Standards provided upon request from the British Standards Institution.

Std022	BS 5752-6:1983*ISO 3726-1983	Methods of test for coffee and coffee products. Instant coffee. Determination of loss in mass at 70<deg>C under reduced pressure
Std023	BS 5752-8:1986*ISO 6667-1985	Methods of test for coffee and coffee products. Green coffee: determination of proportion of insect-damaged beans
Std024	BS 5752-10:1986*ISO 7532-1985	Methods of test for coffee and coffee products. Instant coffee: size analysis
Std025	BS 5752-11:1987*ISO 8460-1987	Methods of test for coffee and coffee products. Instant coffee: determination of free-flow and compacted bulk densities
Std026	BS 5752-13:1995*ISO 11817:1994	Methods of test for coffee and coffee products. Roasted ground coffee. Determination of moisture content. Karl Fischer method (reference method)
Std027	BS 5752-14:1995*ISO 11294:1994	Methods of test for coffee and coffee products. Roasted ground coffee. Determination of moisture content (loss in mass at 103<deg>C (routine method)
Std028***	BS 5752-15:1997*ISO 11292:1995	Methods of test for coffee and coffee products. Instant coffee:determination of free and total carbohydrate contents by high performance anion-exchange chromatography
Std029***	BS 5752-16:1996*ISO 6669:1995	Methods of test for coffee and coffee products. Green and roasted coffee. Determination of free-flow bulk density of whole beans (routine method)
Std030	BS 5987:1980*ISO 1839-1980	Methods for sampling tea
Std031	BS 6008:1980*ISO 3103-1980	Method for preparation of a liquor of tea for use in sensory tests
Std032	BS 6049-1:1981*ISO 1572-1980	Methods of test for tea. Preparation of ground sample of known dry matter content
Std033	BS 6049-2:1981*ISO 1573-1980	Methods of test for tea. Determination of loss in mass at 103<deg>C
Std034***	BS 6049-3:1994*ISO 9768:1994	Methods of test for tea. Determination of water extract
Std035	BS 6049-4:1988*ISO 1575:1987	Methods of test for tea. Determination of total ash
Std036***	BS 6049-5:1989*ISO 1576:1988	Methods of test for tea. Determination of water-soluble ash and water-insoluble ash
Std037	BS 6049-6:1988*ISO 1577:1987	Methods of test for tea. Determination of acid-insoluble ash
Std038	BS 6049-7:1981*ISO 1578-1975	Methods of test for tea. Determination of alkalinity of water-soluble ash
Std039***	BS 6049-9:1999*ISO 15598:1999	Methods of test for tea. Determination of crude fibre content
Std040	BS 6325:1982*ISO 6078-1982	Glossary of terms relating to black tea
Std041	BS 6379-1:1983*ISO 4072-1982	Sampling of coffee and coffee products. Method of sampling green coffee in bags
Std042	BS 6986-1:1988*ISO 7516-1984	Analysis of instant tea. Methods of sampling
Std043	BS 6986-2:1988*ISO 6770-1982	Analysis of instant tea. Methods for determination of free-flow and compacted bulk densities
Std044	BS 6986-3:1990+A1:2012*ISO 7513:1990	Instant tea in solid form. Determination of moisture content (loss in mass at 103<deg>)
Std045	BS 6986-4:1990*ISO 7514:1990	Analysis of instant tea. Method for determination of total ash
Std046	BS 7390:1990*ISO 6079:1990	Specification for instant tea
Std047	PD ISO/TR 12591:2013	White tea. Definition
Std048***	BS ISO 1446:2001+A1:2011	Green coffee. Determination of water content. Basic reference method

Std048a	2011 amendment of ISO 1446	
Std049	BS ISO 2451:2014	Cocoa beans. Specification
Std050***	BS ISO 3509:2005	Coffee and coffee products. Vocabulary
Std051	BS ISO 3720:2011	Black tea. Definition and basic requirements
Std052*	BS ISO 4149:2005	Green coffee. Olfactory and visual examination and determination of foreign matter and defects
Std053	BS ISO 4150:2011	Green coffee or raw coffee. Size analysis. Manual and machine sieving
Std054	BS ISO 6666:2011	Coffee sampling. Triers for green coffee or raw coffee and parchment coffee
Std055*	BS ISO 6668:2008	Green coffee. Preparation of samples for use in sensory analysis
Std056*	BS ISO 6670:2002	Instant coffee. Sampling method for bulk units with liners
Std057***	BS ISO 6673:2003	Green coffee. Determination of loss in mass at 105<deg>C
Std058	BS ISO 8455:2011+A1:2015	Green coffee. Guidelines for storage and transport
Std058a	2015 amendment of ISO 8455	
Std059*	BS ISO 9116:2004	Green coffee. Guidelines on methods of specification
Std060***	BS ISO 10470:2004	Green coffee. Defect reference chart
Std061***	BS ISO 10727:2002	Tea and instant tea in solid form. Determination of caffeine content. Method using high-performance liquid chromatography
Std062	BS ISO 11286:2004	Tea. Classification of grades by particle size analysis
Std063	BS ISO 11287:2011	Green tea. Definition and basic requirements
Std064	BS ISO 14502-1:2005	Determination of substances characteristic of green and black tea. Content of total polyphenols in tea. Colorimetric method using Folin-Ciocalteu reagent
Std065	BS ISO 14502-2:2005	Determination of substances characteristic of green and black tea. Content of catechins in green tea. Method using high-performance liquid chromatography
Std066***	BS ISO 20481:2008	Coffee and coffee products. Determination of the caffeine content using high performance liquid chromatography (HPLC). Reference method
Std067	BS ISO 20938:2008	Instant coffee. Determination of moisture content. Karl Fischer method (Reference method)
Std068	BS ISO 24114:2011	Instant coffee. Criteria for authenticity
Std069	BS ISO 24115:2012	Green coffee. Procedure for calibration of moisture meters. Routine method
Std070***	BS EN 14132:2009	Foodstuffs. Determination of ochratoxin A in barley and roasted coffee. HPLC method with immunoaffinity column clean-up
Std071	BS EN 16618:2015	Food analysis. Determination of acrylamide in food by liquid chromatography tandem mass spectrometry (LC-ESI-MS/MS)
Std072	BS EN 16620:2015	Food analysis. Determination of furan in coffee and coffee products by headspace gas chromatography and mass spectrometry (HS GC-MS)
Std073	BS 4585-11:1983*ISO 5567-1982	Methods of test for spices and condiments. Determination of volatile organic sulphur compounds in dehydrated garlic
Std074	BS 7611:1992	Specification for potato storage boxes for mechanical handling
Std075*	BS ISO 762:2003	Fruit and vegetable products. Determination of mineral impurities content
Std076	BS ISO 763:2003	Fruit and vegetable products. Determination of ash insoluble

		in hydrochloric acid
Std078	BS ISO 2173:2003	Fruit and vegetable products. Determination of soluble solids. Refractometric method
Std079	BS ISO 5518:2007	Fruits, vegetables and derived products. Determination of benzoic acid content. Spectrophotometric method
Std079	BS ISO 6561-1:2005	Fruits, vegetables and derived products. Determination of cadmium content. Method using graphite furnace atomic absorption spectrometry
Std080	BS ISO 6561-2:2005	Fruits, vegetables and derived products. Determination of cadmium content. Method using flame atomic absorption spectrometry
Std081	BS EN ISO 16050:2011	Foodstuffs. Determination of aflatoxin B1, and the total content of aflatoxins B1, B2, G1 and G2 in cereals, nuts and derived products. High-performance liquid chromatographic method
Std082***	BS ISO 17239:2004	Fruits, vegetables and derived products. Determination of arsenic content. Method using hydride generation atomic absorption spectrometry
Std083	BS ISO 17240:2004	Fruit and vegetable products. Determination of tin content. Method using flame atomic absorption spectrometry
Std084	BS EN 12014-2:1997	Foodstuffs. Determination of nitrate and/or nitrite content. HPLC/IC method for the determination of nitrate content of vegetables and vegetable products
Std085***	BS EN 12014-5:1997	Foodstuffs. Determination of nitrate and/or nitrite content. Enzymatic determination of nitrate content of vegetable-containing food for babies and infants
Std086***	BS EN 12014-7:1998	Foodstuffs. Determination of nitrate and/or nitrite content. Continuous flow method for the determination of nitrate content of vegetables and vegetable products after cadmium reduction
Std087***	BS EN 12393-1:2013	Foods of plant origin. Multiresidue methods for the determination of pesticide residues by GC or LC-MS/MS. General considerations
Std088	BS EN 12393-2:2013	Foods of plant origin. Multiresidue methods for the determination of pesticide residues by GC or LC-MS/MS. Methods for extraction and clean-up
Std089	BS EN 12393-3:2013	Foods of plant origin. Multiresidue methods for the determination of pesticide residues by GC or LC-MS/MS. Determination and confirmatory tests
Std090	BS EN 14177:2003	Foodstuffs. Determination of patulin in clear and cloudy apple juice and puree. HPLC method with liquid/liquid partition clean-up
Std091***	BS EN 14185-1:2003	Non-fatty food. Determination of N-methylcarbamate residues. HPLC-method with SPE clean-up
Std092***	BS EN 14185-2:2006	Non fatty foods. Determination of N-methylcarbamate residues. HPLC method with clean-up on a diatomaceous earth column
Std093**	BS EN 14333-1:2004	Non fatty foods. Determination of benzimidazole fungicides carbendazim, thiabendazole and benomyl (as carbendazim). HPLC method with solid phase extraction clean up
Std094***	BS EN 14333-2:2004	Non fatty foods. Determination of benzimidazole fungicides carbendazim, thiabendazole and benomyl (as carbendazim). HPLC method with gel permeation chromatography clean up
Std095	BS EN 14333-3:2004	Non-fatty foods. Determination of benzimidazole fungicides carbendazim, thiabendazole and benomyl (as carbendazim). HPLC method with liquid/liquid-partition clean up

Std096	BS EN 15054:2006	Non fatty foods. Determination of chlormequat and mepiquat. LC-MS method
Std097	BS EN 15055:2006	Non fatty foods. Determination of chlormequat and mepiquat. LC-MS/MS method
Std098	BS EN 15829:2010	Foodstuffs. Determination of ochratoxin A in currants, raisins, sultanas, mixed dried fruit and dried figs. HPLC method with immunoaffinity column cleanup and fluorescence detection
Std099***	BS EN 15890:2010	Foodstuffs. Determination of patulin in fruit juice and fruit based purée for infants and young children. HPLC method with liquid/liquid partition cleanup and solid phase extraction and UV detection
Std100***	BS EN 16618:2015	Food analysis. Determination of acrylamide in food by liquid chromatography tandem mass spectrometry (LC-ESI-MS/MS)
Std101	BS EN ISO 16050:2011	Foodstuffs. Determination of aflatoxin B1, and the total content of aflatoxins B1, B2, G1 and G2 in cereals, nuts and derived products. High-performance liquid chromatographic method
Std102	BS EN 1787:2000	Foodstuffs. Detection of irradiated food containing cellulose by ESR spectroscopy
Std103***	BS EN 14123:2007	Foodstuffs. Determination of aflatoxin B1 and the sum of aflatoxin B1, B2, G1 and G2 in hazelnuts, peanuts, pistachios, figs, and paprika powder. High performance liquid chromatographic method with post-column derivatisation and immunoaffinity column cleanup
Std104***	BS 4585-2:1982	Methods of test for spices and condiments. Determination of moisture content (entrainment method)
Std105	BS 4585-3:1998*ISO 928:1997	Methods of test for spices and condiments. Determination of total ash
Std106**	BS 4585-6:1992	Methods of test for spices and condiments. Determination of non-volatile ether extract
Std107	BS 4585-7:1989	Methods of test for spices and condiments. Determination of Scoville index of chillies
Std108	BS 4585-8:1977*ISO 3588:1977	Methods of test for spices and condiments. Determination of degree of fineness of grinding - hand sieving method (reference method)
Std109	BS 4585-9:1998*ISO 930:1997	Methods of test for spices and condiments. Determination of acid-insoluble ash
Std110	BS 4585-11:1983*ISO 5567:1982	Methods of test for spices and condiments. Determination of volatile organic sulphur compounds in dehydrated garlic
Std111	BS 4585-12:1983*ISO 5564:1982	Methods of test for spices and condiments. Determination of piperine content of pepper
Std112	BS 4585-13:1983*ISO 5566:1982	Methods of test for spices and condiments. Determination of colouring power of turmeric
Std113	BS 4585-14:1983*ISO 1208:1982	Methods of test for spices and condiments. Determination of filth
Std114	BS EN ISO 676:2009	Spices and condiments. Botanical nomenclature
Std115	BS EN ISO 927:2009	Spices and condiments. Determination of extraneous matter and foreign matter content
Std116***	BS EN ISO 948:2009	Spices and condiments. Sampling
Std117*	BS ISO 1003:2008	Spices. Ginger (Zingiber officinale Roscoe). Specification
Std118	BS ISO 2254:2004	Cloves, whole and ground (powdered). Specification
Std119*	BS EN ISO 2825:2010	Spices and condiments. Preparation of a ground sample for analysis

Std120*	BS EN ISO 3493:2014	Vanilla. Vocabulary
Std121	BS ISO 3632-1:2011	Spices. Saffron (Crocus sativus L.). Specification
Std122	BS ISO 3632-2:2010	Spices. Saffron (Crocus sativus L.). Test methods
Std123***	BS EN ISO 6465:2009	Spices. Cumin (Cuminum cyminum L.). Specification
Std124	BS ISO 6539:2014	Cinnamon (Cinnamomum zeylanicum Blume). Specification
Std125*	BS EN ISO 6571:2009	Spices, condiments and herbs. Determination of volatile oil content (hydrodistillation method)
Std126***	BS ISO 6576:2004	Laurel (Laurus nobilis L.). Whole and ground leaves
Std127	BS EN ISO 7540:2010	Ground paprika (Capsicum annuum L.). Specification
Std128	BS EN ISO 7541:2010	Ground (powdered) paprika. Determination of total natural colouring matter content
Std129	BS EN 16466-1:2013	Vinegar. Isotopic analysis of acetic acid and water. <UP>2H-NMR analysis of acetic acid
Std130	BS EN 16466-2:2013	Vinegar. Isotopic analysis of acetic acid and water. <UP>1<UP>3C-IRMS analysis of acetic acid
Std131	BS EN 16466-3:2013	Vinegar. Isotopic analysis of acetic acid and water. <UP>1<UP>8O-IRMS analysis of water in wine vinegar

Note: Std077, as code identifier, not included.

***Standards included in both the aggregate and product-specific estimation approach

**Standards only included in the aggregate estimation approach

*Standards only included in the product-specific estimation approach

Appendix C: Empirical results baseline model

Aggregate estimation approach

Table 6: Effect of GDP and Standard variables on export flows from SSA countries to the EU - consideration of aggregated export flows of cocoa, fruits, vegetables and coffee for consecutive years and for 3 and 4-year interval data (robustness test)

	Dependent variable: log Trade volume		
	Annual data (1)	**3yr interval (2)**	**4yr interval (3)**
log GDP	-0.175	-0.255	-0.280
	(0.277)	(0.329)	(0.421)
std001	-0.272	-	-
	(0.238)		
std002	-0.494	-	-
	(0.325)		
std004	-1.873***	-	-
	(0.281)		
std005	0.680**	-	0.009
	(0.266)		(0.062)
std012	-2.102***	-	-
	(0.594)		
std013	-0.825***	-0.508**	-
	(0.210)	(0.209)	
std014	1.735**	-	0.177
	(0.832)		(0.859)
std017	-1.188***	-0.750***	-
	(0.142)	(0.252)	
std018	-0.782***	-	-0.070
	(0.240)		(0.080)
std028	-1.956***	-0.821**	0.110
	(0.611)	(0.376)	(0.226)
std029	-0.646***	-	-0.522
	(0.219)		(0.588)
std034	-0.184	0.528	-0.091
	(0.145)	(0.353)	(0.234)
std036	-0.554***	-0.955***	1.720
	(0.097)	(0.175)	(1.635)
std039	0.573***	-	-
	(0.156)		
std048	1.512***	-	-
	(0.351)		
std050	0.746**	-	-
	(0.326)		
std057	0.817**	-0.766**	-0.021
	(0.388)	(0.375)	(0.087)
std060	2.498***	-	-
	(0.580)		
std061	-1.820***	0.485	-0.194
	(0.502)	(0.370)	(0.267)
std066	-3.281***	-0.353	-0.006
	(0.491)	(0.373)	(0.047)

std070	-0.270	-1.009***	-1.941
	(0.323)	(0.246)	(1.620)
std082	2.343***	-0.258*	-
	(0.565)	(0.153)	
std085	-1.182**	0.356	-
	(0.537)	(0.404)	
std086	0.199***	0.452	-0.258***
	(0.069)	(0.282)	(0.096)
std087	0.980***	-0.807	-
	(0.291)	(0.615)	
std091	-0.057	-0.424	-0.346
	(0.286)	(0.490)	(0.220)
std092	0.166**	0.326	-
	(0.072)	(0.203)	
std093	0.563**	-	1.150***
	(0.283)		(0.347)
std094	-1.448***	-	0.511
	(0.266)		(0.386)
std100	-0.575**	-	-
	(0.289)		
std103	-1.160*	-0.313	-0.375
	(0.628)	(0.695)	(0.372)
std104	-0.645***	-	-
	(0.199)		
std106	-1.686***	-	-0.283
	(0.530)		(0.220)
std116	1.469***	0.693***	-0.187
	(0.413)	(0.224)	(0.126)
std119	1.884**	-0.675*	-
	(0.871)	(0.351)	
std120	-0.409***	-	-
	(0.133)		
std123	-0.810***	-	-
	(0.211)		
std126	-0.332	0.799**	-
	(0.344)	(0.370)	
Standard total	-0.817*	0.654***	-0.412
	(0.454)	(0.244)	(0.546)
Sum of Stds	0.112**	0.037**	-0.003
	(0.045)	(0.015)	(0.008)
Constant	6.016	8.348	9.628
	(7.267)	(8.224)	(10.572)
No. of standards	38	19	18
Observations	2824	970	790
R-squared	0.894	0.919	0.899
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt

Notes: Results presented are for Poisson model of trade volume on standard dummies, standard total dummy and sum of standards. Standard dummies are equal to unity for years in which the standard was adopted by the respective EU country, standard total is equal to unity for years in which at least 1 standard was adopted by the respective EU country, and sum of standards is defined as the count of the number of adopted standards in a particular year. In column (1), the data are annual, comprising up to 2824 observations for 94 trade pairs among 49 countries (39 exporters and 10 importers) over the 1980-2012 time horizon. In column (2), we use a 3-year interval such that $Trade\ volume \in \{1982; 1985; 1988; 1991; 1994;\ 1997; 2000; 2003; 2006; 2009; 2012\}$ and in column (3),

we use a 4-year interval such that $Trade\ volume \in \{1980; 1984; 1988; 1992; 1996;\ 2000; 2004; 2008; 2012\}$. Fixed effects are included as indicated but not reported: *i* & *j* – importer and exporter ('directional') fixed effects; *ij* – country-pair fixed effects; it – importer ('directional')-time fixed effects; jt – exporter ('directional')-time fixed effects. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Product-specific estimation approach

Table 7: Effect of GDP and Standard variables export flows from SSA countries to the EU for the product group cocoa for consecutive years and for 3 and 4-year interval data (robustness test)

	(1)	(2)	(3)
Data	**Consecutive**	**3-year interval**	**4-year interval**
logGDP	-0.431	0.337	-0.817
	(0.298)	(0.339)	(0.691)
std017	-0.412	-0.349	-0.366
	(0.560)	(0.309)	(0.230)
Standard total - cocoa	a)	a)	a)
Sum of standards - cocoa	0.316**	-0.620***	-0.018
	(0.147)	(0.200)	(0.317)
Constant	13.289*	-5.798	23.493
	(7.593)	(8.012)	(18.169)
Observations	1106	382	325
R-squared	0.939	0.962	0.940

Notes: Results presented are for Poisson model of trade volume on standard dummies, standard total dummy and sum of standards. Standard dummies are equal to unity for years in which the standard was adopted by the respective EU country, standard total is equal to unity for years in which at least 1 standard was adopted by the respective EU country, and sum of standards is defined as the count of the number of adopted standards in a particular year. In column (1), the data are annual, whereas in column (2), we use a 3-year interval such that $Trade\ volume \in \{1982; 1985; 1988; 1991; 1994;\ 1997; 2000; 2003; 2006; 2009; 2012\}$ and in column (3), we use a 4-year interval such that $Trade\ volume \in \{1980; 1984; 1988; 1992; 1996;\ 2000; 2004; 2008; 2012\}$. Fixed effects are included but not reported. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

a) The coefficient for *'Standard total'* is not determined because the dummy was excluded from the regression to ensure that the estimates exist.

Table 8: Effect of GDP and Standard variables export flows from SSA countries to the EU for the product group fruits for consecutive years and for 3 and 4-year interval data (robustness test)

	(1)	(2)	(3)
Data	**Consecutive**	**3-year interval**	**4-year interval**
logGDP	-0.509	-1.509	-1.225**
	(0.421)	(0.000)	(0.552)
std004	0.248***	-0.917	0.350
	(0.083)	(0.000)	(0.364)

std005	-1.384***	-1.918	-5.341**
	(0.191)	(0.000)	(2.636)
std007	-2.903***	1.069	
	(0.363)	(0.000)	
std010		-1.855	
		(0.000)	
std012	-1.073	-0.881	-1.731***
	(1.476)	(0.000)	(0.642)
std013	0.917***		
	(0.276)		
std014	0.166	-0.746	1.032**
	(0.227)	(0.000)	(0.486)
Standard total - fruit	a)	a)	a)
Sum of standards - fruit	0.490**	0.610	0.280
	(0.236)	(0.000)	(0.192)
Constant	14.870	42.559	32.278**
	(10.761)	(0.000)	(13.496)
Observations	1622	570	474
R-squared	0.872	0.899	0.903

Notes: Results presented are for Poisson model of trade volume on standard dummies, standard total dummy and sum of standards. Standard dummies are equal to unity for years in which the standard was adopted by the respective EU country, standard total is equal to unity for years in which at least 1 standard was adopted by the respective EU country, and sum of standards is defined as the count of the number of adopted standards in a particular year. In column (1), the data are annual, whereas in column (2), we use a 3-year interval such that $Trade\ volume \in \{1982; 1985; 1988; 1991; 1994;\ 1997; 2000; 2003; 2006; 2009; 2012\}$ and in column (3), we use a 4-year interval such that $Trade\ volume \in \{1980; 1984; 1988; 1992; 1996;\ 2000; 2004; 2008; 2012\}$. Fixed effects are included but not reported. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

[a)] The coefficient for 'Standard total' is not determined because the dummy was excluded from the regression to ensure that the estimates exist.

Table 9: Effect of GDP and Standard variables export flows from SSA countries to the EU for the product group vegetables for consecutive years and for 3 and 4-year interval data (robustness test)

	(1)	(2)	(3)
Data	**Consecutive**	**3-year interval**	**4-year interval**
logGDP	0.430	-0.469	-1.337
	(0.464)	(1.062)	(1.256)
std075	-2.215***	1.872	-0.431
	(0.678)	(2.537)	(0.871)

std082	0.591	3.455	-7.556
	(0.794)	(2.706)	(6.439)
std085	0.719	-0.995	
	(0.825)	(1.015)	
std086	0.069	0.310	-1.993***
	(0.220)	(0.716)	(0.707)
std087	-0.835**	2.720	
	(0.391)	(1.669)	
std091	-0.518**		
	(0.261)		
std092	-0.767	-0.758	-2.694
	(0.493)	(0.806)	(2.554)
std094	-0.576	3.026	-4.457
	(1.236)	(2.363)	(3.535)
std099	-1.470***		
	(0.431)		
std100	0.555		
	(0.925)		
std103	-0.572	0.639	-0.075
	(1.092)	(0.573)	(0.333)
std104	-0.300	0.459	
	(0.435)	(0.450)	
Standard total - veg	a)	a)	a)
Sum of standards - veg	0.189	-0.483	0.675
	(0.359)	(0.389)	(0.559)
Constant	-9.407	14.126	36.923
	(12.298)	(27.621)	(32.248)
Observations	1446	492	413
R-squared	0.890	0.919	0.894

Notes: Results presented are for Poisson model of trade volume on standard dummies, standard total dummy and sum of standards. Standard dummies are equal to unity for years in which the standard was adopted by the respective EU country, standard total is equal to unity for years in which at least 1 standard was adopted by the respective EU country, and sum of standards is defined as the count of the number of adopted standards in a particular year. In column (1), the data are annual, whereas in column (2), we use a 3-year interval such that $Trade\ volume \in \{1982; 1985; 1988; 1991; 1994;\ 1997; 2000; 2003; 2006; 2009; 2012\}$ and in column (3), we use a 4-year interval such that $Trade\ volume \in \{1980; 1984; 1988; 1992; 1996;\ 2000; 2004; 2008; 2012\}$. Fixed effects are included but

not reported. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.
[a)] The coefficient for *'Standard total'* is not determined because the dummy was excluded from the regression to ensure that the estimates exist.

Table 10: Effect of GDP and Standard variables export flows from SSA countries to the EU for the product group coffee for consecutive years and for 3 and 4-year interval data (robustness test)

	(1)	(2)	(3)
Data	**Consecutive**	**3-year interval**	**4-year interval**
logGDP	-0.397	-0.820	-0.855*
	(0.349)	(0.657)	(0.470)
std028	-1.060	1.161**	
	(0.710)	(0.560)	
std029	-0.157		-0.657
	(0.125)		(0.488)
std034	1.158***	0.864	3.187***
	(0.306)	(0.752)	(1.132)
std036	-1.879	0.878**	-2.018**
	(1.505)	(0.424)	(0.825)
std039	1.066	0.667	
	(0.925)	(1.031)	
std048	-0.758***	0.408	2.459***
	(0.164)	(0.515)	(0.549)
std050	2.069*	-1.181	
	(1.099)	(1.052)	
std052	-3.431*		
	(2.082)		
std055	-1.113**	0.126	
	(0.550)	(0.532)	
std056	0.525**		
	(0.233)		
std057	-1.950***	0.122	1.794***
	(0.553)	(0.337)	(0.472)
std059	0.940***		
	(0.287)		
std060	2.077*		
	(1.068)		
std061	0.213	0.316	-1.433***
	(0.159)	(0.252)	(0.181)
std066	0.286	0.002	0.777***
	(0.288)	(0.271)	(0.231)
std070	-1.622**	2.711	-3.185***
	(0.780)	(1.682)	(0.907)
std116	-0.526	0.653**	1.735***
	(0.690)	(0.291)	(0.596)
std117	-0.018		
	(0.411)		
std119	-1.585		
	(1.979)		
std120	0.134	-2.468***	
	(0.388)	(0.519)	

std123	-0.812		
	(0.829)		
std125	-0.548***		
	(0.171)		
std126	-0.114	-1.125	
	(0.785)	(1.158)	
Standard total - coffee	1.830	-0.984***	1.084***
	(1.408)	(0.191)	(0.348)
Sum of standards - coffee	0.077	-0.008	-0.085***
	(0.086)	(0.020)	(0.020)
Constant	12.716	23.600	25.571**
	(9.107)	(16.764)	(12.724)
Observations	2,045	694	547
R-squared	0.894	0.913	0.917

Notes: Results presented are for Poisson model of trade volume on standard dummies, standard total dummy and sum of standards. Standard dummies are equal to unity for years in which the standard was adopted by the respective EU country, standard total is equal to unity for years in which at least 1 standard was adopted by the respective EU country, and sum of standards is defined as the count of the number of adopted standards in a particular year. In column (1), the data are annual, whereas in column (2), we use a 3-year interval such that $Trade\ volume \in \{1982; 1985; 1988; 1991; 1994;\ 1997; 2000; 2003; 2006; 2009; 2012\}$ and in column (3), we use a 4-year interval such that $Trade\ volume \in \{1980; 1984; 1988; 1992; 1996;\ 2000; 2004; 2008; 2012\}$. Fixed effects are included but not reported. White heteroscedasticity-robust standard errors in reported parentheses. Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Appendix D: Empirical results model extension

Product-specific estimation approach

Table 11: Effect of 'Proxy' for ability to comply with international standards and interaction term on export flows from SSA countries to the EU for the product group cocoa

	Dependent variable: log Export Flows Cocoa (1980-2012)						
	Adherence to ISO standards				**Parameters business sophistication**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Product group:	**ISO9001**	**ISO9001/**	**ISO14001**	**ISO14001/**	**Value added share (in % of GDP) of**		
Cocoa	**(abs)**	**Pop**	**(abs)**	**Pop**	**Agriculture**	**Services**	**Manufacturing**
logGDP	0.024	0.022	0.022	0.024	0.023	0.022	0.018
	(0.022)	(0.000)	(0.022)	(0.022)	(0.000)	(0.000)	(0.000)
"Sum of Standards"	0.188***	0.754	-0.048	0.043	0.015	0.131	-0.116
	(0.043)	(0.000)	(0.056)	(0.041)	(0.000)	(0.000)	(0.000)
"Standard total"	0.015	-0.005	-0.020	0.002	-0.025	-0.018	0.122
	(0.015)	(0.000)	(0.024)	(0.011)	(0.000)	(0.000)	(0.000)
"Proxy"	-0.068***	-0.138	0.017	0.092***	0.051	0.017	-0.114
	(0.015)	(0.000)	(0.015)	(0.008)	(0.000)	(0.000)	(0.000)
Interaction	0.015	-0.020	-0.005	0.002	-0.025	-0.018	0.122
	(0.015)	(0.024)	(0.000)	(0.011)	(0.000)	(0.000)	(0.000)
Constant	2.151***	2.055	2.177***	1.983***	1.810	1.633	2.792
	(0.128)	(0.000)	(0.138)	(0.132)	(0.000)	(0.000)	(0.000)
Observations	1,106	1,107	1,107	1,106	1,107	1,107	1,106
R-squared	0.939	0.937	0.937	0.939	0.937	0.937	0.941
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

Notes: Results presented are for Poisson model of trade volume on standard total dummy and sum of standards. Standard total is equal to unity for years in which at least 1 standard was adopted by the respective EU country, and sum of standards is defined as the count of the number of adopted standards in a particular year. The data are annual, comprising up to 2825 observations for 94 trade pairs among 49 countries (39 exporters and 10 importers) over the 1980-2012 time horizon. Fixed effects are included as indicated but not reported: *ij* – country-pair fixed effects; *it* – importer ('directional')-time fixed effects; *jt* – exporter ('directional')-time fixed effects. White heteroscedasticity-robust standard errors reported in parentheses.
Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 12: Effect of 'Proxy' for ability to comply with international standards and interaction term on export flows from SSA countries to the EU for the product group fruits

	Dependent variable: log Export Flows Fruits (1980-2012)						
	Adherence to ISO standards				**Parameters business sophistication**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Product group:	**ISO9001**	**ISO9001/**	**ISO14001**	**ISO14001/**	**Value added share (in % of GDP) of**		
Fruit	**(abs)**	**Pop**	**(abs)**	**Pop**	**Agriculture**	**Services**	**Manufacturing**
logGDP	0.021	0.020	0.021	0.021	0.021	0.022	0.022
	(0.026)	(0.026)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
"Sum of Standards"	-0.046**	-0.030***	-0.132***	0.033	-0.105***	0.228***	-0.258***
	(0.020)	(0.011)	(0.024)	(0.024)	(0.013)	(0.018)	(0.017)
"Standard total"	0.523***	-0.126	-0.195	-0.447***	0.178*	-0.972***	0.367**
	(0.113)	(0.081)	(0.133)	(0.117)	(0.095)	(0.182)	(0.166)
"Proxy"	0.056**	-0.011	0.369***	0.093***	-0.124***	-0.013	0.074***
	(0.026)	(0.014)	(0.084)	(0.029)	(0.013)	(0.031)	(0.028)
Interaction	-0.010	0.005	-0.230***	-0.077***	0.001	-0.031	-0.023
	(0.019)	(0.013)	(0.082)	(0.027)	(0.010)	(0.029)	(0.026)
Constant	1.738***	1.688***	1.400***	1.455***	2.686***	1.871***	1.190***
	(0.197)	(0.157)	(0.157)	(0.155)	(0.149)	(0.247)	(0.229)
Observations	1,622	1,622	1,622	1,622	1,622	1,622	1,622
R-squared	0.872	0.872	0.872	0.872	0.872	0.872	0.872
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

Notes: Results presented are for Poisson model of trade volume on standard total dummy and sum of standards. Standard total is equal to unity for years in which at least 1 standard was adopted by the respective EU country, and sum of standards is defined as the count of the number of adopted standards in a particular year. The data are annual, comprising up to 2825 observations for 94 trade pairs among 49 countries (39 exporters and 10 importers) over the 1980-2012 time horizon. Fixed effects are included as indicated but not reported: *ij* – country-pair fixed effects; *it* – importer ('directional')-time fixed effects; *jt* – exporter ('directional')-time fixed effects. White heteroscedasticity-robust standard errors reported in parentheses.
Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 13: Effect of 'Proxy' for ability to comply with international standards and interaction term on export flows from SSA countries to the EU for the product group vegetables

	Dependent variable: log Export Flows Vegetables (1980-2012)						
	Adherence to ISO standards				**Parameters business sophistication**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Product group:	**ISO9001**	**ISO9001/**	**ISO14001**	**ISO14001/**	**Value added share (in % of GDP) of**		
Vegetables	**(abs)**	**Pop**	**(abs)**	**Pop**	**Agriculture**	**Services**	**Manufacturing**
logGDP	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.028)	(0.028)	(0.029)	(0.029)	(0.028)	(0.028)	(0.028)
"Sum of Standards"	-0.033***	-0.094***	-0.098***	-0.079***	-0.003	-0.060***	0.003
	(0.012)	(0.012)	(0.013)	(0.014)	(0.015)	(0.014)	(0.012)
"Standard total"	-0.010	0.580***	0.828***	0.016	0.102	-0.065	-0.459*
	(0.136)	(0.147)	(0.175)	(0.150)	(0.192)	(0.159)	(0.245)
"Proxy"	-0.025	-0.001	0.142***	0.081***	0.076***	-0.144***	0.052***
	(0.027)	(0.024)	(0.029)	(0.021)	(0.022)	(0.015)	(0.014)
Interaction	0.002	0.004	0.007	-0.007	-0.014	0.022	0.044**
	(0.024)	(0.023)	(0.020)	(0.016)	(0.020)	(0.034)	(0.017)
Constant	1.981***	1.567***	1.427***	2.573***	0.780***	2.313***	1.433***
	(0.158)	(0.173)	(0.167)	(0.175)	(0.278)	(0.206)	(0.221)
Observations	1,446	1,446	1,446	1,446	1,446	1,446	1,446
R-squared	0.890	0.890	0.890	0.890	0.890	0.890	0.890
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

Notes: Results presented are for Poisson model of trade volume on standard total dummy and sum of standards. Standard total is equal to unity for years in which at least 1 standard was adopted by the respective EU country, and sum of standards is defined as the count of the number of adopted standards in a particular year. The data are annual, comprising up to 2825 observations for 94 trade pairs among 49 countries (39 exporters and 10 importers) over the 1980-2012 time horizon. Fixed effects are included as indicated but not reported: *ij* – country-pair fixed effects; *it* – importer ('directional')-time fixed effects; *jt* – exporter ('directional')-time fixed effects. White heteroscedasticity-robust standard errors reported in parentheses.
Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Table 14: Effect of 'Proxy' for '*ability to comply*' with international standards and interaction term on export flows from SSA countries to the EU for the product group coffee

	Dependent variable: log Export Flows Coffee (1980-2012)						
	Adherence to ISO standards				**Parameters business sophistication**		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Product group:	**ISO9001**	**ISO9001/**	**ISO14001**	**ISO14001/**	**Value added share (in % of GDP) of**		
Coffee	**(abs)**	**Pop**	**(abs)**	**Pop**	**Agriculture**	**Services**	**Manufacturing**
logGDP	0.058**	0.059**	0.058**	0.058**	0.059**	0.059**	0.059**
	(0.026)	(0.026)	(0.025)	(0.026)	(0.026)	(0.026)	(0.026)
"Sum of Standards"	0.032***	0.015***	-0.013***	-0.023***	-0.010***	0.003	-0.002
	(0.005)	(0.005)	(0.002)	(0.005)	(0.002)	(0.002)	(0.002)
"Standard total"	-0.082	-0.029	0.005	0.829***	0.248**	-0.942***	-0.180***
	(0.123)	(0.139)	(0.036)	(0.058)	(0.102)	(0.072)	(0.055)
"Proxy"	0.012	0.080***	0.058***	0.039**	0.069***	-0.076***	-0.026*
	(0.013)	(0.013)	(0.016)	(0.017)	(0.019)	(0.009)	(0.015)
Interaction	-0.008*	-0.004	-0.030***	-0.009**	-0.010	-0.004	0.010
	(0.004)	(0.003)	(0.007)	(0.004)	(0.009)	(0.008)	(0.007)
Constant	1.258***	1.467***	1.997***	1.738***	1.224***	2.616***	2.125***
	(0.167)	(0.170)	(0.163)	(0.155)	(0.225)	(0.185)	(0.146)
Observations	2,046	2,046	2,046	2,046	2,046	2,046	2,046
R-squared	0.889	0.889	0.890	0.890	0.890	0.889	0.889
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

Notes: Results presented are for Poisson model of trade volume on standard total dummy and sum of standards. Standard total is equal to unity for years in which at least 1 standard was adopted by the respective EU country, and sum of standards is defined as the count of the number of adopted standards in a particular year. The data are annual, comprising up to 2825 observations for 94 trade pairs among 49 countries (39 exporters and 10 importers) over the 1980-2012 time horizon. Fixed effects are included as indicated but not reported: *ij* – country-pair fixed effects; *it* – importer ('directional')-time fixed effects; *jt* – exporter ('directional')-time fixed effects. White heteroscedasticity-robust standard errors reported in parentheses.
Statistical significance: *** p<0.01, ** p<0.05, * p<0.1.

Appendix E: Robustness test results for the model extension

Aggregate estimation approach

Table 15: Effect of 'Proxy' for ability to comply with international standards and interaction term on export flows from SSA countries to the EU (consideration of aggregated export flows of cocoa, coffee, fruits and vegetables), applying 3 and 4-year interval data

	Dependent variable: log Export Flows, 3 year intervals (1980-2012)						
	Adherence to ISO standards				Parameters business sophistication		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ISO9001	ISO9001/	ISO14001	ISO14001/	Value added share (in % of GDP) of		
	(abs)	Pop	(abs)	Pop	Agriculture	Services	Manufacturing
logGDP	0.032	0.031	0.031	0.031	0.002	-0.000	0.001
	(0.029)	(0.029)	(0.029)	(0.029)	(0.011)	(0.011)	(0.011)
"Sum of Standards"	-0.149	-0.166	-0.219*	-0.321*	-0.038	0.120	-0.135
	(0.186)	(0.140)	(0.129)	(0.173)	(0.036)	(0.102)	(0.083)
"Standard total"	-0.010***	-0.006***	-0.008***	-0.004	0.002***	0.002***	0.002***
	(0.002)	(0.001)	(0.002)	(0.002)	(0.000)	(0.000)	(0.000)
"Proxy"	-0.043***	0.040***	-0.159***	-0.031	-0.006	0.000	-0.024
	(0.013)	(0.014)	(0.025)	(0.021)	(0.007)	(0.014)	(0.017)
Interaction	-0.007	-0.001	0.010	0.003	0.007	-0.018	0.023
	(0.011)	(0.009)	(0.016)	(0.007)	(0.007)	(0.015)	(0.016)
Constant	2.438***	2.404***	2.467***	2.251***	2.092***	1.940***	2.193***
	(0.150)	(0.169)	(0.176)	(0.159)	(0.060)	(0.117)	(0.102)
Observations	970	970	970	970	970	970	970
R-squared	0.919	0.919	0.919	0.919	0.839	0.839	0.840
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

	Dependent variable: log Export Flows, 4 year intervals (1980-2012)						
	Adherence to ISO standards				Parameters business sophistication		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	ISO9001	ISO9001/	ISO14001	ISO14001/	Value added share (in % of GDP) of		
	(abs)	Pop	(abs)	Pop	Agriculture	Services	Manufacturing
logGDP	0.064**	0.063**	0.064**	0.062**	0.011	0.006	0.010
	(0.027)	(0.027)	(0.027)	(0.028)	(0.012)	(0.011)	(0.012)
"Sum of Standards"	0.649***	0.425***	0.254	0.097	-0.044	-0.052	-0.129
	(0.171)	(0.118)	(0.170)	(0.086)	(0.038)	(0.124)	(0.116)
"Standard total"	0.005**	0.002	-0.013***	-0.009***	0.001***	0.002***	0.001***
	(0.003)	(0.002)	(0.003)	(0.002)	(0.000)	(0.000)	(0.000)
"Proxy"	0.060***	-0.001	0.049*	0.233***	-0.008	-0.031	-0.019
	(0.018)	(0.011)	(0.026)	(0.016)	(0.009)	(0.021)	(0.021)
Interaction	-0.023*	-0.016	-0.008	-0.006	0.006	0.007	0.019
	(0.013)	(0.011)	(0.016)	(0.007)	(0.007)	(0.019)	(0.020)
Constant	1.124***	1.057***	1.498***	0.726***	2.052***	2.101***	2.009***
	(0.258)	(0.213)	(0.261)	(0.218)	(0.087)	(0.150)	(0.132)
Observations	790	790	790	791	791	791	791
R-squared	0.900	0.900	0.900	0.897	0.830	0.831	0.831
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

Robust standard errors in parentheses

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

Product-specific estimation approach

Table 16: Effect of 'Proxy' for ability to comply with international standards and interaction term on export flows from SSA countries to the EU for the product group cocoa, applying 3 and 4-year interval data

	Dependent variable: log Export Flows Cocoa, 3 year intervals (1980-2012)						
	Adherence to ISO standards				Parameters business sophistication		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Product group:	ISO9001	ISO9001/	ISO14001	ISO14001/	Value added share (in % of GDP) of		
Cocoa	(abs)	Pop	(abs)	Pop	Agriculture	Services	Manufacturing
logGDP	0.058*	0.053*	0.058*	0.058*	0.053*	0.047	0.051
	(0.032)	(0.031)	(0.033)	(0.032)	(0.030)	(0.031)	(0.032)
"Sum of Standards"	0.284	0.357***	0.219***	0.145*	0.973***	3.395***	-1.422***
	(0.386)	(0.064)	(0.041)	(0.083)	(0.284)	(0.297)	(0.217)
"Standard total"	-0.043	-0.901***	-0.036	0.018	-0.221**	-1.381***	0.274**
	(0.202)	(0.343)	(0.048)	(0.028)	(0.099)	(0.120)	(0.109)
"Proxy"	2.104***	1.843***	2.412***	2.535***	2.683***	1.831***	4.057***
	(0.223)	(0.244)	(0.209)	(0.201)	(0.225)	(0.269)	(0.269)
Interaction	-0.038**	0.364***	-0.145***	-0.121***	-0.128***	0.283***	-0.243***
	(0.015)	(0.139)	(0.031)	(0.013)	(0.019)	(0.030)	(0.025)
Constant	2.104***	1.843***	2.412***	2.535***	2.683***	1.831***	4.057***
	(0.223)	(0.244)	(0.209)	(0.201)	(0.225)	(0.269)	(0.269)
Observations	382	382	382	382	382	382	382
R-squared	0.962	0.964	0.962	0.962	0.964	0.966	0.964
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

	Dependent variable: log Export Flows Cocoa, 4 year intervals (1980-2012)						
	Adherence to ISO standards				Parameters business sophistication		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Product group:	ISO9001	ISO9001/	ISO14001	ISO14001/	Value added share (in % of GDP) of		
Cocoa	(abs)	Pop	(abs)	Pop	Agriculture	Services	Manufacturing
logGDP	0.079**	0.074**	0.073**	0.075**	0.074**	0.073**	0.064**
	(0.033)	(0.032)	(0.032)	(0.033)	(0.032)	(0.032)	(0.030)
"Sum of Standards"	-0.122**	-0.075	-0.012	0.330***	0.146	0.059	0.134*
	(0.059)	(0.068)	(0.041)	(0.047)	(0.142)	(0.100)	(0.075)
"Standard total"	a)	a)	a)	a)	a)	a)	a)
"Proxy"	0.083***	0.228***	-0.049	-0.009	-0.071***	-0.143***	-0.285***
	(0.014)	(0.011)	(0.042)	(0.013)	(0.024)	(0.015)	(0.024)
Interaction	0.027	0.013	0.024	0.031	-0.019	-0.002	0.077
	(0.021)	(0.018)	(0.030)	(0.019)	(0.045)	(0.033)	(0.082)
Constant	1.359***	0.411*	1.392***	1.028***	1.955***	2.547***	3.182***
	(0.210)	(0.211)	(0.201)	(0.193)	(0.197)	(0.217)	(0.227)
Observations	324	325	325	325	325	325	325
R-squared	0.949	0.941	0.941	0.941	0.940	0.940	0.943
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

Robust standard errors in parentheses

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

[a)] Results for the *'Standard total'* variable could not be determined, because the dummy is excluded from the regression to ensure that the estimates exist.

Table 17: Effect of 'Proxy' for ability to comply with international standards and interaction term on export flows from SSA countries to the EU for the product group fruits, applying 3 and 4-year interval data

	Dependent variable: log Export Flows Fruits, 3 year intervals (1980-2012)						
	Adherence to ISO standards				Parameters business sophistication		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Product group:	ISO9001	ISO9001/	ISO14001	ISO14001/	Value added share (in % of GDP) of		
Fruits	(abs)	Pop	(abs)	Pop	Agriculture	Services	Manufacturing
logGDP	0.071	0.071	0.074	0.074	0.074	0.076	0.075
	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)
"Sum of Standards"	0.051***	0.012*	0.020*	0.029**	0.009	-0.045***	-0.027
	(0.010)	(0.007)	(0.011)	(0.014)	(0.014)	(0.014)	(0.019)
"Standard total"	-0.171	0.149	0.755***	0.448***	0.227	0.416	a)
	(0.152)	(0.120)	(0.193)	(0.163)	(0.162)	(0.358)	
"Proxy"	0.052**	-0.002	0.202***	0.011	0.062***	0.011	0.096**
	(0.020)	(0.019)	(0.078)	(0.034)	(0.019)	(0.042)	(0.044)
Interaction	0.031**	0.021*	-0.222***	-0.049*	-0.008	-0.030	-0.006
	(0.014)	(0.011)	(0.083)	(0.029)	(0.010)	(0.040)	(0.034)
Constant	1.204***	1.472***	1.143***	1.464***	1.386***	1.206***	0.900**
	(0.336)	(0.373)	(0.288)	(0.307)	(0.393)	(0.382)	(0.384)
Observations	570	570	570	570	570	570	570
R-squared	0.899	0.899	0.899	0.899	0.899	0.899	0.899
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

	Dependent variable: log Export Flows Fruits, 4 year intervals (1980-2012)						
	Adherence to ISO standards				Parameters business sophistication		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Product group:	ISO9001	ISO9001/	ISO14001	ISO14001/	Value added share (in % of GDP) of		
Fruits	(abs)	Pop	(abs)	Pop	Agriculture	Services	Manufacturing
logGDP	0.083	0.082	0.083	0.083	0.087*	0.081	0.081
	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)
"Sum of Standards"	-0.047***	0.003	0.018	-0.076***	-0.064***	-0.026	-0.029***
	(0.009)	(0.015)	(0.014)	(0.015)	(0.021)	(0.019)	(0.010)
"Standard total"	-0.178	-0.160	0.013	0.356***	0.167	a)	a)
	(0.171)	(0.139)	(0.102)	(0.121)	(0.140)		
"Proxy"	0.122**	-0.041	0.275**	0.108**	-0.150***	0.042	-0.114
	(0.052)	(0.049)	(0.107)	(0.042)	(0.025)	(0.075)	(0.073)
Interaction	-0.088*	0.009	-0.276***	-0.102***	0.036	0.005	-0.007
	(0.051)	(0.041)	(0.095)	(0.035)	(0.026)	(0.034)	(0.074)
Constant	1.513***	1.682***	1.410***	1.698***	1.629***	0.918**	2.478***
	(0.259)	(0.258)	(0.279)	(0.289)	(0.251)	(0.362)	(0.292)
Observations	474	474	474	474	474	474	474
R-squared	0.904	0.902	0.903	0.903	0.903	0.902	0.902
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

Robust standard errors in parentheses

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

[a)] Results for the *'Standard total'* variable could not be determined, because the dummy is excluded from the regression to ensure that the estimates exist.

Table 18: Effect of 'Proxy' for ability to comply with international standards and interaction term on export flows from SSA countries to the EU for the product group vegetables, applying 3 and 4-year interval data

	Dependent variable: log Export Flows Vegetables, 3 year intervals (1980-2012)						
	Adherence to ISO standards				Parameters business sophistication		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Product group:	ISO9001	ISO9001/	ISO14001	ISO14001/	Value added share (in % of GDP) of		
Vegetables	(abs)	Pop	(abs)	Pop	Agriculture	Services	Manufacturing
logGDP	0.044	0.045	0.046	0.046	0.044	0.046	0.044
	(0.058)	(0.059)	(0.059)	(0.059)	(0.058)	(0.060)	(0.058)
"Sum of Standards"	-0.072***	-0.052**	-0.089***	-0.041***	0.073**	-0.028	-0.071***
	(0.020)	(0.022)	(0.018)	(0.015)	(0.033)	(0.024)	(0.025)
"Standard total"	-0.122	-0.352***	0.439**	-0.314**	a)	-0.808***	a)
	(0.135)	(0.125)	(0.184)	(0.128)		(0.275)	
"Proxy"	-0.196***	-0.060***	-0.215***	-0.053***	0.067***	0.267***	-0.018
	(0.031)	(0.022)	(0.030)	(0.017)	(0.021)	(0.021)	(0.029)
Interaction	0.008	0.004	0.108***	0.055***	-0.024	0.000	0.051**
	(0.030)	(0.029)	(0.029)	(0.011)	(0.021)	(0.036)	(0.025)
Constant	2.436***	2.014***	1.425***	1.723***	0.961**	0.206	1.854***
	(0.360)	(0.304)	(0.327)	(0.350)	(0.385)	(0.473)	(0.244)
Observations	493	493	493	493	493	493	493
R-squared	0.911	0.911	0.911	0.911	0.911	0.911	0.911
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

	Dependent variable: log Export Flows Vegetables, 4 year intervals (1980-2012)						
	Adherence to ISO standards				Parameters business sophistication		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Product group:	ISO9001	ISO9001/	ISO14001	ISO14001/	Value added share (in % of GDP) of		
Vegetables	(abs)	Pop	(abs)	Pop	Agriculture	Services	Manufacturing
logGDP	-0.024	-0.024	-0.024	-0.024	-0.024	-0.024	-0.024
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
"Sum of Standards"	0.087***	0.069***	0.212***	0.152***	0.082	0.020	-0.059**
	(0.010)	(0.016)	(0.016)	(0.021)	(0.141)	(0.053)	(0.025)
"Standard total"	-0.330	0.011	-2.289***	-2.155***	a)	a)	a)
	(0.726)	(0.326)	(0.161)	(0.231)			
"Proxy"	-0.092	-0.128***	-0.143***	-0.098***	0.151	-0.053	0.062
	(0.128)	(0.032)	(0.044)	(0.025)	(0.228)	(0.039)	(0.042)
Interaction	-0.158	0.031	0.021	0.013	-0.391	0.104	-0.026
	(0.210)	(0.042)	(0.028)	(0.017)	(0.519)	(0.139)	(0.034)
Constant	2.451***	2.388***	2.184***	2.388***	2.023***	2.235***	2.522***
	(0.199)	(0.178)	(0.214)	(0.178)	(0.272)	(0.344)	(0.293)
Observations	413	413	413	413	413	413	413
R-squared	0.894	0.894	0.894	0.894	0.894	0.894	0.894
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

Robust standard errors in parentheses

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

[a)] Results for the *'Standard total'* variable could not be determined, because the dummy is excluded from the regression to ensure that the estimates exist.

Table 19: Effect of 'Proxy' for ability to comply with international standards and interaction term on export flows from SSA countries to the EU for the product group coffee, applying 3 and 4-year interval data

	Dependent variable: log Export Flows Coffee, 3 year intervals (1980-2012)						
	Adherence to ISO standards				Parameters business sophistication		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Product group:	ISO9001	ISO9001/	ISO14001	ISO14001/	Value added share (in % of GDP) of		
Coffee	(abs)	Pop	(abs)	Pop	Agriculture	Services	Manufacturing
logGDP	0.111*	0.114*	0.110*	0.111*	0.113*	0.112*	0.113*
	(0.063)	(0.062)	(0.061)	(0.062)	(0.060)	(0.062)	(0.062)
"Sum of Standards"	0.009**	0.047***	0.004	-0.001	-0.007***	-0.007***	-0.035***
	(0.004)	(0.004)	(0.004)	(0.005)	(0.003)	(0.002)	(0.006)
"Standard total"	-1.179***	-1.366***	-0.828***	-0.511	0.132	0.001	-2.460***
	(0.213)	(0.227)	(0.141)	(0.419)	(0.101)	(0.141)	(0.382)
"Proxy"	-0.215***	-0.121***	-0.146***	-0.107***	-0.065***	-0.139***	-0.120***
	(0.019)	(0.011)	(0.041)	(0.020)	(0.024)	(0.045)	(0.043)
Interaction	-0.003	0.006	-0.024**	-0.007	-0.022	0.007	0.015
	(0.007)	(0.007)	(0.010)	(0.005)	(0.018)	(0.017)	(0.012)
Constant	2.734***	2.598***	2.182***	2.101***	2.028***	2.497***	3.073***
	(0.351)	(0.365)	(0.329)	(0.372)	(0.466)	(0.477)	(0.406)
Observations	695	695	695	695	695	695	695
R-squared	0.901	0.901	0.901	0.901	0.902	0.901	0.901
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

	Dependent variable: log Export Flows Coffee, 4 year intervals (1980-2012)						
	Adherence to ISO standards				Parameters business sophistication		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Product group:	ISO9001	ISO9001/	ISO14001	ISO14001/	Value added share (in % of GDP) of		
Coffee	(abs)	Pop	(abs)	Pop	Agriculture	Services	Manufacturing
logGDP	0.057*	0.058*	0.057*	0.056	0.058*	0.061*	0.055
	(0.034)	(0.035)	(0.033)	(0.034)	(0.033)	(0.034)	(0.034)
"Sum of Standards"	0.024***	0.015***	0.033***	0.009***	0.006***	0.018***	0.003
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.002)
"Standard total"	1.017***	1.279***	0.960***	0.087	0.140*	-0.817***	-0.020
	(0.067)	(0.097)	(0.073)	(0.070)	(0.072)	(0.148)	(0.100)
"Proxy"	-0.143***	-0.131***	0.022	0.013	0.043***	0.021	0.133***
	(0.011)	(0.013)	(0.015)	(0.012)	(0.016)	(0.015)	(0.020)
Interaction	-0.009	-0.005	-0.034***	-0.014**	-0.012	0.033**	0.019
	(0.007)	(0.005)	(0.011)	(0.007)	(0.012)	(0.013)	(0.014)
Constant	-0.265	-0.147	-0.464**	1.252***	1.153***	1.513***	0.701***
	(0.229)	(0.244)	(0.192)	(0.183)	(0.206)	(0.247)	(0.228)
Observations	547	547	547	547	547	547	547
R-squared	0.916	0.916	0.918	0.917	0.916	0.918	0.916
FE (i,j,t)	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt	ij, it, jt

Robust standard errors in parentheses

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

Appendix F: List of included SSA and EU countries

Table 20: List of the 39 Sub-Saharan African countries included in the regressions

1	Benin	21	Madagascar
2	Botswana	22	Malawi
3	Burkina Faso	23	Mali
4	Burundi	24	Mauritius
5	Cameroon	25	Mozambique
6	Cape Verde	26	Namibia
7	Central African Republic	27	Niger
8	Comoros	28	Nigeria
9	Republic of the Congo	29	Sao Tome and Principe
10	Djibouti	30	Senegal
11	Eritrea	31	Seychelles
12	Ethiopia	32	Sierra Leone
13	Gabon	33	South Africa
14	Gambia	34	Sudan
15	Ghana	35	Swaziland
16	Guinea	36	Togo
17	Guinea-Bissau	37	Uganda
18	Ivory Coast	38	Zambia
19	Kenya	39	Zimbabwe
20	Lesotho		

Table 21: List of the 10 European countries included in the regressions

1	Austria	6	Italy
2	Belgium	7	Netherlands
3	France	8	Poland
4	Germany	9	Spain
5	Ireland	10	Sweden

Appendix G: Summary of interviews on experts' perception of the relationship between standards and market access and the role of standards for African countries

(We obtained the consent of the interview partners for the official usage of their names and positions.)

Title	Name	Surname	Position	Organisation	Key points
Mr	Christian	Vidal-León	Dispute Settlement Lawyer at Legal Affairs Division	World Trade Organization	• For agricultural, private standards play a significant role: An example being the standards of large supermarkets, particularly in terms of quality (private standards). • There is an understanding that standards will have a more negative effect on trade in agricultural goods/less processed goods. • There is no preference for suppliers from specific countries but there is a preference in terms of quality (private standards). • General notion is that standards are trade enhancing whereas regulations are not necessarily so. In other words, the moment standards become mandatory, they may lose their ability to enhance trade. • Another viewpoint is that standards decrease the level of trade in developing countries. • The EC's "New Approach" means that standards approved by the European standardising body must be adopted by countries as is.
Dr	Elsabe	Steyn	Executive	South African National Accreditation System (SANAS)	• From South Africa's side the National Regulator for Compulsory Specification (www.nrcs.org.za) is appointed by the EU to do inspections. • Black spot collaboration between SA and EU citrus exports.
Mr	Rudolf	Brits	Director: Market Access	South African Department of Trade and Industry	• The benefit of standard compliance is guaranteed market access. If there is compliance with government regulations, goods should enter a market without problem. If not, the importing government may be in breach of its WTO obligations. • There are many mandatory requirements in the EU to ensure public health and safety and the protection of the environment. • Since the establishment of the WTO in 1995 to date, the EU has submitted 1,271 notifications of draft technical regulations and conformity assessment procedures for comment from trading

					partners. • Due to the EU internal market requirements, almost all standards and technical regulations are required to be harmonised to prevent internal technical barriers to trade in the EU. • Article 2.4 of the WTO TBT Agreement requires Members to base their technical regulations on international standards. Since South Africa adopts mostly ISO standards as national standards, it can be assumed that South African standards and technical regulations are in many circumstances more or less equivalent to EU regulations/standards. • The South African National Accreditation System (SANAS) has a mutual recognition agreement with the European Accreditation of Laboratories Cooperation (EAL) covering testing and calibration. SANAS is also active within the International Laboratory Accreditation Cooperation (ILAC) as well as the International Accreditation Forum (IAF). • Although SANAS is a signatory to both the ILAC and IAF, tests and certification done by accredited domestic facilities are not always accepted and re-certification is sometimes required. This is time consuming and costly for exporters, especially small- and medium sized enterprises. • For exporters, the main challenges are: Lack of information on the regulation requirements; wrong interpretation of the requirements; long delays in getting certification and the accompanying costs; and the uncertainty on whether the certification will be accepted. • Private standards are usually more stringent than public standards and may differ from company to company, which makes it difficult to produce for more than one importing company. This is perpetuated by the opacity of private standards. • Private standards could necessitate exporters focusing on a specific importer and thus may hamper export diversification.
Dr	Howard	Sigwele	Executive Director	Delta Dairies (Pty),	• Compliance with standards is very significant for market access: Requirements limit/restrict the free movement of cattle and

				Botswana	restrict free trade. Standards are thus non-tariff barriers to trade.
Ms	Jennifer	Rathebe	Retired	Previously: Trademark Southern Africa	• Producers opting to sell in rural townships, where there is no middleman and no need to deal with all the requirements. • It is very difficult for small-scale producers to comply: Expensive and prohibitive. • Standard compliance is very significant. It might be the standards themselves or the information around what is expected (the availability and access to that information and then the interpretation of the standards). • Small producers export through commercial exporters rather than doing it themselves. • Private standards are an added burden: Meeting the official standards does not necessarily open up the market. • If standards are complied with, infrastructural barriers remain.
Mr	Junior	Lodge	Team leader	ACP EU TBT programme (Brussels)	• The UNCTAD data suggests that standards, in the cluster of non-tariff barriers (NTBs), are the most important one in terms of usage. This conforms to the anecdotal evidence. • The EU applies technical barriers to trade (TBT) measures in a more pervasive manner than any other trading partner. • When you are already in the value chain, you do everything possible to maintain your presence in the market. Therefore, standards may be more of a barrier to new entrants. • Traceability requirements of supermarkets, particularly in the UK, are very exacting, demanding and, by extension, also costly to apply. • The development and application of standards, and the development of accreditation bodies, the establishment of laboratories and conformity assessment mechanisms is all very costly and most countries just cannot afford it. • ACP countries will always find it challenging to compete in the higher end of the value chain, so they are condemned to become, or remain, producers of commodities. • 19 WTO members have notified of concession under the LDC services waiver and if countries, particularly LDCs/African, Caribbean, Pacific (ACP) LDCs, do not improve their regulatory

					framework for services, then they will be back to a similar scenario to the 'Everything But Arms' (EBA) agreement. They will have market access to the biggest market in the world but they will be unable to fully utilize this because they don't have either the policy framework or competitiveness required to contest. • Regulatory capacity was the basis on which effective market access was secured, but it is now evolving into specific interventions which are required.
Mr	Paul	Brenton	Trade Practice Leader in the Africa Region	World Bank	• Build capacity and knowledge through exporting to regional markets, and then expand to EU. • Standards compliance often requires considerable investments in processes and procedures to ensure that they can be met (e.g. supermarket standards). • One argument is that international standards have been developed by advanced countries. • Quality issues as mandatory standards can be trade restricting. • It is very difficult for new products to get into a market. If a firm is already exporting and proving compliance, then it is easier for other firms to get into the market. • Mutual recognition rather than harmonization.
Mr	Hermogene	Nsengimana	Secretary General	African Organisation for Standardisation (ARSO)	• There is very low participation in international standards from Sub-Saharan countries. If you remove South Africa, Tanzania, Kenya and Ethiopia, most countries are not really participating. • The main challenge is the numerous conformity assessments, mainly dictated by the private sector. Many requirements are dictated by the trading country, and depending on the company you are trading with, because they are on a private scheme of conformity. • The main challenge for SSA countries is the range of standards that have to be applied, and understanding the technical issues.
Mr	John	Keyser	Senior agriculture trade economist	World Bank	• Mutual recognition rather than harmonization. • WTO agreements (Sanitary and Phytosanitary Agreement (SPS) and TBT) talk about regulations being used for genuine health and safety or animal and plant health issues. However, the maize standard, which includes specific parameters for important things like Aflatoxin and Mycotoxin, which are

					genuine health and safety issues, also excludes broken or discoloured grains and this really just relates to private value and should not be in included in the standard.

Note: Transcripts of these interviews are available on request.