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Private Food Standards and Firm-Level Trade Effects: A Dynamic Analysis of the Peruvian Asparagus Export Sector

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Abstract

Private standards are increasingly governing international food trade, but little is known about the implications for developing countries. The objective of the study is to provide evidence in the ongoing debate on standards as barrier or catalyst for developing countries' export. We use the Peruvian fresh asparagus export sector as a case study and provide empirical panel data evidence on the effects of certification to private food standards on export volumes of firms. Our dataset on the transactions of 567 export firms from 1993 to 2011 allows us to take export dynamics and time trends into account, as well as to keep country and sector specific effects constant. In our empirical strategy, we first use simple OLS and ignore firm-specific unobservable effects and dynamic export patterns. We then account for export persistence, as well as company fixed effects and finally, use System-GMM estimators to address potential reversed causality issues. These approaches represent substantial methodological improvements compared with previous studies on the trade effects of private standards. The empirical innovation is crucial for accurate impact estimation, as results indicate that certification to standards has a positive effect on the export volumes of companies, but that the significant effect dwindles as soon as unobserved firm heterogeneity and export persistency are properly controlled for. Additional studies with large data availabilities are needed to further disentangle the effect and confirm the case study results.

Key Words: Horticultural exports, Private standards, Trade effects, Developing countries, Dynamic panel

JEL classification: C23, F13, L15, O13, Q17

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Introduction

Standards are increasingly governing international trade in agricultural and food products (Jaffee & Henson, 2004; Henson & Reardon, 2005). These standards are set by public authorities, i.e., public standards, or by private food companies and other non-state actors, i.e., private standards. While public standards mainly focus on food quality and safety issues and compliance is usually compulsory, private standards often additionally focus on ethical and environmental concerns of food production and trade and company's adherence is typically made on a voluntary basis (Humphrey, 2008). This creates a non-regulated area that goes beyond the competence of national authorities and opens up a new debate on the legal dimensions of private standards (Marx, Maertens, Swinnen & Wouters, 2012); for example on whether and how private sector standards should fall under the WTO's SPS Agreement (WTO, 2007).

A main concern is that standards in general, and private standards in particular, create new non-tariff barriers to trade. It has been argued that standards especially diminish the export opportunities of poor countries who do not have the financial and technical capacity to meet strict requirements (Garcia-Martinez & Poole, 2004; Unnevehr, 2000). Others have argued that standards could spur developing country exports because they induce processes of production system upgrading and supply chain modernization and lead to the re-positioning of countries and companies in global markets (Henson & Jaffee, 2008; Jaffee & Masakure, 2005; Jaffee & Henson, 2004; Maertens & Swinnen, 2006). The Kenyan fresh produce export sector has for example been mentioned to have thrived because it has met the challenge of rising standards and has used this as an opportunity to redefine the industry's competitive advantage (Jaffee, 2003).

There is a growing body of empirical literature that aims at providing evidence in this debate on standards-as-barriers versus standards-as-catalyst to trade. The main part of the evidence comes from macro-economic trade models, usually gravity models, that estimate the impact of increasing standards on international trade flows. This literature has mainly focused on the trade effects of public standards and mainly points to evidence in support of the standards-as-barriers view. For example, Anders & Caswell (2009) find that mandatory HACCP standards for fish imports in the US strongly reduced US imports from developing countries. Wilson & Otsuki (2003) and Wilson, Otsuki & Majumdar (2003) find that public regulations on aflatoxin in nuts and hormones in beef in high-income countries reduce exports from developing countries but that a harmonization of diverging national standards according to the prescriptions of the Codex Alimentarius could increase trade. Similarly, Czubala, Shepherd, & Wilson (2007) find evidence that non harmonized standards reduce African exports of textile products, but that EU standards which are harmonized to ISO standards are less trade restricting. Otsuki, Wilson, & Sewadeh (2001) find that aflatoxin standards in the EU reduced groundnut exports from African countries. However, this result was refuted by Xiong and Beghin (2012) who show, using data from a longer time period with more variation in aflatoxin regulation, that the standard had no impact on African exports and does not act as a barrier to trade.

Empirical evidence from gravity models is very informative in the debate but fails to capture microeconomic effects. Individual companies and producers may react differently to increasing standards, resulting in different trade impacts. Especially in analyzing the trade effects of private standards this company heterogeneity might matter importantly as this concerns voluntary standards and companies choose whether to comply or not. Some authors have analyzed firm-level trade effects of public standards, and again point to negative effects of standards for developing countries' exports. For example, Chen, Otsuki, & Wilson (2006)

find that technical regulations decrease the export propensity of companies in developing countries and the number of markets they can enter. Maskus, Otsuki, & Wilson (2005) estimate the impact of technical regulations on companies production costs and conclude that standards act as barriers because they substantially increase production costs. To the best of our knowledge, there is only one study that provides evidence on the firm-level trade effects of private standards[2]. Henson, Masakure, & Cranfield (2011) empirically investigate the impact of GlobalGAP on the export revenue of fresh produce exporters in 10 African countries. Their results support the standards-as-catalyst point of view and suggest that certification to private standards schemes has considerably increased firms' export revenues.

A main problem with these micro-economic studies is that they all use cross-sectional data from several countries and sectors to analyze the firm-level trade effects of standards. With such data it is impossible to take into account export dynamics and to control for country, sector and company heterogeneity. Specifically in the analysis of private standards this might be problematic because not all companies adhere to the standards and the decision to do so might depend on unobserved heterogeneity and past export performance, which might lead to an overestimation of the impact of private standards from cross-sectional data.

In this paper, we analyze firm-level trade effects of private standards in the fresh asparagus export sector in Peru. Due to the size of the industry with around 100 exporting firms per year, its long history and availability of panel data for the period 1993-2011, and its changing international trade relations, the Peruvian asparagus export sector represents a unique case-study from a scientific perspective. Country and sector specific aspects can be held constant, export persistence can be taken into account, and unobserved heterogeneity and company self-

[2] There is however a large body of literature that focuses on the effects of standards, including private standards, for farmers and workers in developing countries (e.g., Maertens & Swinnen, 2009; Asfaw, Mithoefer & Waibel, 2010; Colen, Maertens & Swinnen, 2012). The focus in this literature is more on welfare impacts and less on trade impacts.

selection into private standards compliance can be corrected for. These are important methodological improvements in comparison with previous cross-sectional firm-level research on the trade effects of private standards.

The structure of this paper is as follows: we first describe the Peruvian fresh asparagus export data and firm sampling strategy. We then provide descriptive evidence on the evolution of export volumes, private food certification schemes and the firm characteristics of our firm sample. Further, we define our estimation strategy and report econometric results, as well as robustness checks. We conclude with some policy implications and ideas on future research directions.

Data

We use a unique firm level dataset on Peruvian asparagus exports constructed from secondary sources and own original data collection. First, secondary data include custom data (SUNAT - Peru) at a transaction level on fresh asparagus exports over the period 1993 - 2011. This dataset contains information on 567 fresh asparagus export firms and includes the identification of the exporter (firms' names and tax identification number), the exported volume, the destination market and the FOB value for all export transactions. We merge this dataset with tax administration data, containing information on the foundation date of the firms, core activities, general managers, location, branches, as well as historical fiscal benefits or irregularities.

Second, we complement these secondary data with primary data from a survey among a representative sample of export companies. From the total population of 567 firms that at least once exported fresh asparagus between 1993 and 2011, we draw a stratified random sample of 100 companies. We randomly selected companies from three mutually exclusive strata, according to the companies exporting experience: *consolidated companies* with ≥ 6

years of exporting experience (total population of 63 companies), *intermediate companies*, between 3 and 5 years of exporting experience (90 companies) and *start off companies* with ≤ 2 years of experiences (414 companies). To ensure the representativeness of the sample and due to the relatively lower number of the first two categories, we oversample the first two strata. The sample includes both companies that are operative in 2011, as well as companies that ceased operations by that year, which ensures its representativeness not only for the current situation but for the whole period. The survey was implemented between July and September 2011 using an original questionnaire including recall questions on certification to private food standards, on ownership and management structure, on processing and production procedures, and on sourcing and marketing strategies. Due to field logistics 5 of the 100 sampled companies could not be interviewed, while for 3 companies we have missing values on some of the observations included in the regressions. Another 7 surveyed companies only exceptionally export fresh asparagus and are therefore dropped from the sample. This leaves us with a unique firm level dataset of 85 companies[3], including 42 consolidated companies, 27 intermediate companies and 16 start-off companies. Over the entire period they represent 66,2% of the overall fresh asparagus export volume.

The Peruvian asparagus export sector

Increasing exports

The asparagus sector currently accounts for about 25% of the country's total agricultural exports. More than 220,000 mt (metric tons) of asparagus are produced yearly and practically the whole production is exported, either as fresh produce or as frozen or preserved products

[3] As we rely on customs' data, our sample includes only firms that have exported at least once. So, our analysis is conditioned on already exporting. This is not likely to importantly influence our results because, given the absence of a final local destination market, most asparagus production or processing companies have tried to export at least once and are hence in our sample.

(SUNAT, 2011). Production zones range from 400 km south to 800 km north of Lima along the desert coast (Figure 1). Seventy percent of the produce is exported unprocessed, which makes Peru the largest exporter of fresh asparagus worldwide. The main destination markets for fresh asparagus exports are the USA and countries in the European Union. The entire export volume reaches its final destination market from the metropolitan area of Lima, either by airplanes (85 % of the product) or refrigerated ships. Oversea shipments represent the highest transport cost burden, while costs for local transportation from the production zones to Lima play a minor role and do not considerably affect the competitiveness across the different locations.

[Take in Figure 1]

The history of cultivation and export of asparagus from Peru goes back to the 1950s, when imported seeds from Californian (USA) were first planted in La Libertad region in Northern Peru. Production and export did not expand considerably until the seeds spread to the Ica region, located south of Lima, during the mid 1980s. The sector further expanded during the 1990s and 2000s, with the sharpest growth in fresh produce exports during the early years 2000 (Figure 2) due to the introduction of new neo-liberal land policies promoting private investment in agriculture (Shimizu, 2006; O'Brien & Diaz, 2004; Diaz, 2007). Export growth slowed down from 2006 onwards and experienced some small fluctuations due to international market shocks, e.g., in 2006/2007 and 2009, due to the global economic crisis and increasing USD/Peruvian Nuevo Sol exchange rate fluctuations[4].

[Take in Figure 2]

[4] The USD was historically weak as compared to the Peruvian Nuevo Sol at the end of the year 2007/ beginning of 2008.

The number of fresh asparagus export companies has evolved in a similar manner. The number has tripled from around 40 companies at the end of the 1990s to almost 120 companies in 2006, and remained at around 100 companies per year since 2006. The total number of 567 companies from the custom database that ever exported fresh asparagus since 1993 indicates a large transition in and out of exporting.

Increasing private standards

Private standards started to gain importance in the fresh asparagus export sector in the year 2000 and certification to these standards has spread rapidly in the sector from then onwards. Figure 3 shows, for our 85 sampled companies, the evolution of the certified and non-certified export volumes and the number of certified and non-certified companies over the period 1993-2011.

[Take in Figure 3]

While in 2000 none of the exported produce was certified, by 2003 the export volume of certified firms already exceeded that of non certified firms and by 2005 also the number of certified firms surpassed the number of non-certified firms. The comparison of the relatively large export volume of certified firms and the smaller number of certified firms between 2000 and 2004 indicates that larger companies are more likely to first seek certification to private standards. Since the introduction of private standards in the sector, the export volume of certified asparagus has been increasing sharply until 2006 when export growth slowed down and started to fluctuate along the trend of the overall Peruvian fresh asparagus export volumes (comparison with Figure 2). The non-certified asparagus export volume has decreased sharply between 2000 and 2005 but slowly increased again thereafter and appears to be less affected by international market shocks.

Figure 4 shows the importance of the most widespread types of private standards among our sampled companies. Certainly the most common production standard is GlobalGAP[5]; in 2011 around 30% of export firms were certified to it. The HACCP (*Hazard Analysis and Critical Control Points*)[6] standard held the primacy of most widespread processing standard until 2009, when it was replaced by the more stringent BRC (*British Retail Consortium*) standard, which is held by around 15% of all companies in 2011. BASC (*Business Alliance for Secure Commerce*) is another important certificate that is mainly requested by importers in the US and is held by 14% of the export companies. Other certificates held by asparagus export companies are Tesco, SQF1000, SQF2000, IFS, and Leaf but these are adopted by less than 10% of all companies in 2011 (and are therefore not reported in Figure 4).

[Take in Figure 4]

In what follows we refer to 'certification' and 'certified companies' when companies are certified to at least one of the above mentioned private standards present in the sector. Our interest lies in the trade effect of certification in general and not in the effects of specific private standards.

Company heterogeneity

Before turning to an econometric analysis of the impact of certification on companies export performance, we describe all observable company variables used in the empirical models (Table 1). Most variables in Table 1 are drawn from the total population of asparagus export companies but some variables, indicated with an asterisk, are drawn from the survey sample of companies. We distinguish between time varying, i.e., changing from one year to another, and time constant variables.

[5] This was EurepGAP until 2007. In this paper we refer to "GlobalGAP " even if it concerns a certification before 2007.

[6] HACCP is regarded as a private standard in the Peruvian fresh asparagus export sector, since it is not mandatory for asparagus exports towards any destination and adopted by companies on a voluntary basis

[Take in Table 1]

Further, we address the heterogeneity of firms. For the variables which are considered most important in our analysis, we first compare firm characteristics in 2000, i.e., prior to the spread of private food standards in the asparagus export sector, and 2011, the last year of observation (Table 2). To make correct inferences, the data drawn from the survey sample of companies and representing estimates of sample averages instead of population averages are adjusted for stratification in the sampling method with sampling weights.

[Take in Table 2]

From Table 2 we see that, over the period 2000-2011, the number of export companies increased by 50% and the average company export volume more than doubled. Standard deviations of the mean export volume are large, indicating a large variability in companies' export volume, which has increased from 2000 to 2011. This points towards a growth of the number of actors and their respective size but also an increase in the market shares of the main actors. As already revealed from Figure 4, the likelihood of being certified increased tremendously, from 3% in 2000 to almost 31% in 2011. Also the average number of certificates held by companies and the average number of years of certification increased during that period.

Asparagus export companies vary not only in their export size and certification behavior, but also their basic set up. Some companies have agricultural land and/or a processing plant; others are asparagus "traders" without land or plant. The share of these traders has increased from 25% of the export companies in 2000 to 44% in 2011. These companies typically purchase the raw product from producers, rent in capacity in a processing plant for post-harvest handling and packing, and export produce under their own company name. The share of exporters with own processing plants remained constant around 42% and that of exporters

with own agricultural land decreased slightly from 45% in 2000 to 44% in 2011. On the contrary, the average agricultural land size increased by 6 hectares in the same period, while the already high standard deviation of landholdings more than doubled. This points towards an increasing relevance of trading companies in the market and a huge variation in landholdings across companies, i.e., a larger concentration of land in the hands of fewer companies.

On average, export companies in 2011 have been in existence for about 3 years longer than companies did in 2000 and have 3 years more experience in asparagus export. These small differences indicate that there is a lot of entry and exit of export companies. Yet, 28% of current export firms are pioneer firms, defined as companies that already exported fresh asparagus before 2003. This indicates that, despite a lot of entry and exit, a certain share of companies have remained in the market for a long time. About one fourth of all exporting companies relied on foreign direct investments in the year 2000 and this increased to more than one third in 2011. While the type of exported asparagus – green versus white – did not considerably change, there are some slight changes in the region in which companies operate: the share of companies operating in the Ica region decreased from 67% in 2000 to 55% in 2011 while the share of companies in the region of La Libertad increased from 7% to 27%.

Furthermore, we compare firm characteristics for certified and non-certified companies in 2011 (Table 3). The figures in Table 3 suggest that there are substantial differences between certified and non-certified firms. First, the 2011 export volumes of certified companies are on average almost three times larger than those of non-certified firms. Yet, already in 2005 and 2003, currently certified firms had export volumes that were on average respectively 7 and 34 times larger than currently non-certified firms. The export volume of certified companies has grown at a rate of 163 mt per year on average over the period 2000-2011 while for non-

certified companies this was 49 mt per year. These figures have to be interpreted with care as not many of the currently non-certified companies in the sample were already present in the market in 2003. Yet, they indicate that certified companies perform better in terms of export volume but that this is mainly associated with larger export volumes ex ante, before private standards spread in the sector, and less with larger growth rates.

[Take in Table 3]

Second, certified firms are more likely to own a plant (~88%) and/or agricultural land (96%) than non-certified firms (23% and 25% respectively). None of the certified firms are pure traders without land or plant while slightly more than half of the non-certified firms are pure traders. This is logic as pure traders are not eligible for most certificates because they do not own a certifiable plant or production unit. Also, the average landholdings are substantially larger for certified firms (55 ha) than for non-certified firms (~3 ha).

Third, certified companies are more likely to have foreign capital and are substantially older companies with more years of experience in asparagus export. The latter indicates that there is less entry and exit among certified companies. Indeed, 64% of the currently certified companies are pioneers who were already in the market before 2003 while this is barely 3% for non-certified companies. In addition, also the location of certified and non-certified companies differs slights. 66% of certified companies operate in the Ica Valley and 23% in La Libertad while for non-certified companies this is 60% and 30% respectively.

In summary, the descriptive statistics in Table 2 and 3 show that there are important trends over time since the spread of private standards and important differences between certified and non-certified companies. Whether the observed large difference in export volume between certified and non-certified companies can be attributed to the impact of private standards is still questionable as time trends and confounding factors that influence both the

decision to seek certification and the export volumes need to be controlled for. In the next section we present several econometric methods to deal with company heterogeneity and the endogenous character of certification, and discuss the estimation results.

Econometric analysis of trade effects

Model Specification

To assess whether the observed higher export quantities of certified firms are due to the causal impact of certification we estimate regressions of the following type:

$$ExpVol_{it} = \beta_0 + \beta_1 \mathrm{C_{it}} + \beta_2 ExpVol_{i,t-1} + \beta_3 \mathrm{X_{it}} + \mathrm{D_t} + \nu_{\mathrm{it}} \quad (1)$$

Where $ExpVol_{it}$ is the logarithm of the exported volume of company i in year t. The key variable of interest in the model is certification of company i in year t (C_{it}), which is measured in three different ways: 1/ as a dummy variable for certification (equaling one if company i is certified in year t), 2/ as the number of certificates a company holds (ranging from 0 to 11), and 3/ as the number of years the company has been certified (ranging from 0 to 13,5). $ExpVol_{i,t-1}$ represents a one-year lag of the logarithm of the exported volume of a company. The vector X_{it} is a large set of observable firm characteristics. These include variables related to the type and the size of companies, the experience, assets, access to capital, tax pay regimes, management changes, and location and are described in detail in Table 1. Year dummies D_t are included to control for common macro-economic effects and ν_{it} is the error term.

Estimation technique

The main issue in estimating equation (1) and identifying the causal impact of certification on export performance is the potential endogeneity of the certification variable. The endogeneity could be due to 1/ a potential reversed causality bias, i.e., certification decisions might be

determined by current export volumes, 2/ the fact that certification is eventually predetermined, i.e., it could depend on past export volumes, or 3/ the simultaneity of certification and export volumes, i.e., unobservable factors could contemporaneously affect export volumes and the certification decision.

The process of certification involves a relatively long auditing procedure; we find it therefore reasonable to assume that certification does not depend on current exports and thus to rule out the former reversed causality bias. Yet, past export performance and unobservable firm characteristics, such as managerial ability and internal organization, are both likely to influence the certification decision as well as current export performance, resulting in the two latter types of bias. In the trade literature, such factors have indeed been shown to affect export performance indicators. Roberts and Tybout (1995) for example find in a dynamic export model that sunk costs are large and a significant source of export persistence. Bernard and Jensen (1999, 2004) report a large unobserved heterogeneity and differences in performance between exporters and non-exporters. Failing to control for past export experience and unobservable characteristics would likely lead to an overestimation of the impact of certification on export performance.

We use several estimation techniques to control for dynamic and unobserved effects. First, we ignore firm-specific unobserved effects and the dynamic export pattern and estimate equation (1) using OLS and without controlling for previous export performance, $ExpVol_{i,t-1}$. This procedure has been used in previous studies to estimate the effects of certification on export performance when no systematic panel data were available (e.g., Chen et al., 2006; Henson et al., 2011). If export volumes are sticky or if unobserved factors that are positively (negatively) correlated with certification also positively (negatively) affect export volumes, this method likely results in an overestimation of the effect of certification on export performance. We use a linear method although our dependent variable $ExpVol_{i,t}$ exhibits a

probability mass at 0 because companies do not necessarily export in all years. Tobit models and maximum likelihood estimation might be more appropriate but we opt for OLS estimation for comparability with subsequent models that do take into account unobserved effects. Chay and Hyslop (1998) and Bernard and Jensen (2004) moreover have shown that linear models perform as well as more complex non-linear estimation strategies with unobservable characteristics.

Second, we account for export persistence by including the lag of the dependent export performance variable $ExpVol_{i,t-1}$ as regressor. Since past export performance is likely positively correlated with the current certification decision, we expect the bias on the certification variable to decrease when controlling for export persistence.

Third, we explicitly consider the role of unobserved firm heterogeneity and re-specify equation (1) by decomposing the error term v_{it} in a time-constant and a time-varying component, ε_i and u_{it} respectively:

$$v_{it} = \varepsilon_i + u_{it} \qquad (2)$$

Plugging equation (2) in (1), we obtain an unobserved fixed effects model in which time-constant unobserved heterogeneity ε_i can be controlled for. We estimate the adjusted equation with the standard within (fixed effects) estimator. The standard within-transformation eliminates ε_i but might still yield biased and inconsistent estimates (Nickell, 1981). The lagged export volume $ExpVol_{i,t-1}$ is not strictly exogenous and it has been shown that in this case the coefficient β_2 on $ExpVol_{i,t-1}$ would be biased downward (Bond, 2002). More problematic, also the certification C_{it} variable is likely not strictly exogenous and if a positive shock to past export volumes positively affects the likelihood of certification, the standard fixed effects estimator would also lead to a downward bias in the estimated certification coefficient β_1. A similar upward or downward bias can be expected on any other predetermined variable in X_{it} , related to the 'fixed effect' transformed error term.

Fourth, we estimate the model using the System General Method of Moments (System GMM) approach of Blundell & Bond, 1999. Arellano and Bond (1991) first proposed to deal with the above-described unobserved heterogeneity and endogeneity problems by combining a first difference transformation with an instrumental variable estimation strategy. The within transformation eliminates the fixed firm characteristics ε_i, while lagged levels of the explanatory variables and further lags of the dependent variable are used as instruments in the first-differenced equation to get rid of the endogeneity problem (Arellano & Bond, 1991; Bond, 2002). A potential problem with this estimator are its poor finite sample properties in terms of bias and precision when time series are persistent, because in this case the instruments might be weak predictors of the endogenous changes (Blundell & Bond, 1998). Arellano and Bover (1995) and Blundell and Bond (1999) propose, in addition to the first-differenced moment conditions, also the moment conditions in levels using lagged first-differences of the explanatory and the dependent variables as instruments for the equation in levels. The two different moment conditions are combined in the so called System GMM.

For the choice of the instruments it is important to ascertain whether all included explanatory variables are strictly exogenous, predetermined or simultaneously endogenous, i.e., respectively to be independent, to depend on past or on current export performance. Only time dummies are treated as exogenous. All firm-specific characteristics, including the certification variable, are assumed to be predetermined, except for the total cultivated asparagus land, which is taken as endogenous. We consider this to be the most reasonable assumption, as, except for the rather quick purchase and sale of land, the adaptation of other firm characteristics (including certification) to changes in the export performance is not immediate. For completeness, we also examined the case in which the certification variable was treated as simultaneously endogenous to the export volumes, but results were not affected and we therefore stick to our assumption and treat it as a predetermined variable in the model. All

predetermined variables are instrumented with their levels from one to three inclusive in the difference equation and with their difference lagged once in the levels equation (more lags in the levels equation of the System GMM would be mathematically redundant - Roodman, 2007). For the only simultaneously endogenous variable "asparagus land" the number of instruments is reduced by one, as only lags 2 and up are valid. All instruments are collapsed in order to limit the instrument count (Roodman, 2009). The validity of all instruments and the additional moment conditions from the equation in levels are tested respectively with the Hansen test of the overidentifying restrictions and the Hansen difference test.

Fifth, we use the same system GMM estimator as above but extend the lagged instruments by one level in the difference equation. This comes down to instrumenting all first differenced predetermined variables with their levels from one to four inclusive and the endogenous land variable from two to four inclusive; in the levels equation the number of instruments does not change. To the extent that this specification of the system GMM estimator introduces more information, it should improve efficiency, and at the same time test the robustness of the results to an alternative set of instruments (Roodman, 2007 & 2009).

With this combination of different estimation techniques, we can overcome methodological shortcomings in previous papers that have estimated the impact of certification to private standards on firm-level export performance. We believe that the system GMM estimator gives the most correct estimates with the smallest bias while the OLS and the fixed effects estimators likely result in respectively an upward and downward bias of the effect of private standards on company export performance.

Results and discussion

Tables 4 to 6 report regression results for the five different estimation methods: 1/ OLS without lag of the dependent variable (Model 1), 2/ OLS with lag of the dependent variable (Model 2), 3/ fixed effects estimation (Model 3), 4/ System GMM estimation with up to three period lags as instruments (Model 4) and 5/ and System GMM estimation with up to four period lags as instruments (Model 5). The logarithm of the exported volume, measured in metric tons, is the dependent variable. Certification, the main explanatory variable of interest is specified in three different ways and these results are reported in different tables: 1/ a dummy variable for certification (Table 4), the number of certificates a company holds and its square (Table 5); and the number of years a company has been certified (Table 6) . The full regression results are reported only in Table 4 while in Tables 5 and 6 only the main results, including the coefficients for the certification variables and the lagged export volumes, are reported – estimated coefficients for the control variables are very similar across the models with different specifications for certification, which makes it less interesting to report them all in lengthy tables. Test results for the null hypotheses of no second order autocorrelation of residuals, of the joint validity of all instruments for GMM estimation (Hansen test – overidentification restrictions) and of the joint validity of the additional instruments used by the System GMM estimator (Difference Hansen test) are shown at the bottom in columns 5 and 6 in all three tables. All tests are accepted at around or above the 10% significance level, which confirms the validity of the instruments used.

Our main result is that, when not controlling for time dynamics and unobserved heterogeneities (Model 1), certification has a large and significant positive effect on asparagus export volumes but that the estimated effect reduces sharply and becomes less significant when controlling for time trends (Model 2), and becomes completely insignificant when

additionally controlling for unobserved heterogeneity (Model 3, 4 and 5). This result is consistent for different specifications of the certification variable.

The estimated effects in Model 1 are two to five times larger than in the other models, which is in line with our expectations that OLS without lagged dependent variables overestimates the effect because of a positive correlation between past export performance and certification. When controlling for past export performance (Model 2), the estimated effects reduce but remain significant (at the 10% level) for the number of certificates (Table 5) and the number of years of certification (Table 6). Fixed effects estimation (Model 3) produces estimates that are smaller than in the other models, especially for the number of certificates (Table 5), which is in line with an expected underestimation of the effect. The system GMM estimates are likely the most correct ones with least bias. Since none of the estimated effects in Model 4 and 5 are significant, we need to conclude that certification to private standards did not have a causal impact on the export performance of firms in the Peruvian asparagus sector.

These results do not really support the standards-as-catalyst point of view and contradict previous findings by Henson, Masakure and Cranfield (2011) that certification to GlobalGAP positively affects the export performance of African fresh produce exporters. Part of the explanation for these diverging findings might relate to the nature of the specific cases that are studied. It might well be that in African horticultural export sectors, that developed more recently (Maertens et al., 2011), private standards have a more important impact and have actually stimulated the development of the sector. Peru already had a long tradition of asparagus exports before private standards started to become important in international markets. The contradicting findings might indicate that private standards are less important for staying in the market and increasing companies' market shares than for entering new markets. Yet, also methodological differences likely explain the contradicting findings.

Failure to control for export persistence and for unobserved heterogeneity in previous studies might have led to an overestimation of the impact of private standards.

Further, we find that lagged export volumes have a significant and large positive effect on current export volumes, which is an indication of the expected export persistence. This effect is consistent across the different models and specifications, although, as expected, the coefficients are larger in Model 2 and smaller in Model 3 than in models 4 and 5. This is again an indication of the expected upward and downward bias in respectively the OLS and fixed effects estimations, and pleads in favor of the validity of the models 4 and 5.

Other firm characteristics have an impact on export performance as well. Ownership of a processing plant and agricultural land have a significant positive effect – the effect is decreasing for land. These results indicate that established processing and production companies perform better in the export market than trading companies who easily enter and exit. The age of a company has a u-shaped effect on export performance, with a turning point at 13 years. Export experience on the other hand has an inverse u-shaped effect with a turning point at 9.5 years. Both turning points are within the sample with around 10% of observations beyond the turning point. This implies that experience positively affects export volumes, while the negative effect of company age could be attributed to issues such as idleness or lower adaptability. Finally, having multiple tax identifiers and a status as good taxpayer enters the regression with a positive and significant coefficient. In both cases, either because firms artificially create a second export company (and pay taxes on two small, instead of one large company) or because they are classified as reliable entities by the national tax authority, they face a lower tax burden, which translates into increased export volumes.

[Take in Table 4, 5, 6]

Robustness check

Around 45% of export companies in 2011 were only trading fresh asparagus, by buying from external producers and renting in other exporters' processing facilities. Since they do not own land nor a processing plant they cannot be certified to private food standards. The inclusion of these type of companies could affect our results in either direction: if traders export less than other firms (e.g., due to fluctuations in the provision of primary produce) the certification coefficient would be biased upwards, while if traders export more than other firms (e.g., due to a higher flexibility and an easier adaptation to demand fluctuations), the certification coefficient would be biased downwards. To assure that pooling these different types of companies does not influence our results, we check the robustness of our estimations by excluding the companies for which certification is not applicable (Table 7). This reduces the number of observations from roughly 700 to 500. When comparing the results from Table 7 with those from Tables 4, 5 and 6, we see that all coefficients of the certification variable are reduced and remain insignificant in models 4 and 5. This corroborates our finding that traders in general tend to export less than other firms, and indicates that excluding them from the analysis does not affect our findings. We performed similar robustness controls by restricting the samples to only companies with or only companies without land, and only companies with or without a processing plant. These results do not change our findings and are not reported.

[Take in Table 7]

Conclusion

In this paper we analyzed the firm-level trade effects of increasing private standards in the asparagus export sector in Peru. A simple comparison of export volumes between certified and non-certified companies and a pooled OLS estimation, controlling for observed company effects, revealed that export volumes of certified companies are four to five times those of

non-certified companies. However, when properly controlling for export persistence over time and for unobserved company effects, this positive effect of certification on company export performance disappears. Our results suggest that exports are sticky and that intrinsic and unobserved firm characteristics, such as entrepreneurial ability, openness towards innovations and personal links with importers play an essential role in determining both export volumes and certification to private standards.

Our findings refute the standards-as-catalyst view that has been put forward in the literature and contradict earlier empirical findings on the firm-level trade effects of private standards. Because previous studies failed to control for export persistence and for unobserved effects, they likely overestimated the impact of certification on export performance. The methodological improvements we made – that were possible due to the availability of panel data including a large number of observations over many years – are therefore important. We would definitely urge for the use of panel data and appropriate methods to correctly assess the impact of private food standards.

We recognize that our case-study approach has limitations and that our findings cannot be generalized. The fact that certification to private standards was found to have no impact on the export performance of companies might be related to the specific case-study. Peru is a middle income country and had an established asparagus export sector before the spread of private standards. The effects of private standards might be different in the poorest countries and in less established export sectors. In such cases, export persistence might play a less important role and private standards might be an important market signaling tool. Moreover, we have only looked at export volumes as a performance indicator in our analysis. Private standards and certification might have an effect on export prices and values because they lead to price discrimination or to changes in destination market. In order to corroborate our

conclusions further research is needed on the causal effects of private standards on export values, prices and destinations.

Yet, based on our findings, ongoing investments of NGOs and development agencies to support developing country exporters to comply with private standards and seek certification, are questionable. Especially in middle income countries and in established export sectors with a long history, there might be no return to such development projects.

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Figure 1: Asparagus production areas in Peru, by type of export

Source: "Instituto Peruano de Esparrago y Hortalizas"(IPEH), adapted by authors

Figure 2: Evolution of fresh asparagus export volumes and the number of export companies, Peru, 1993 - 2011

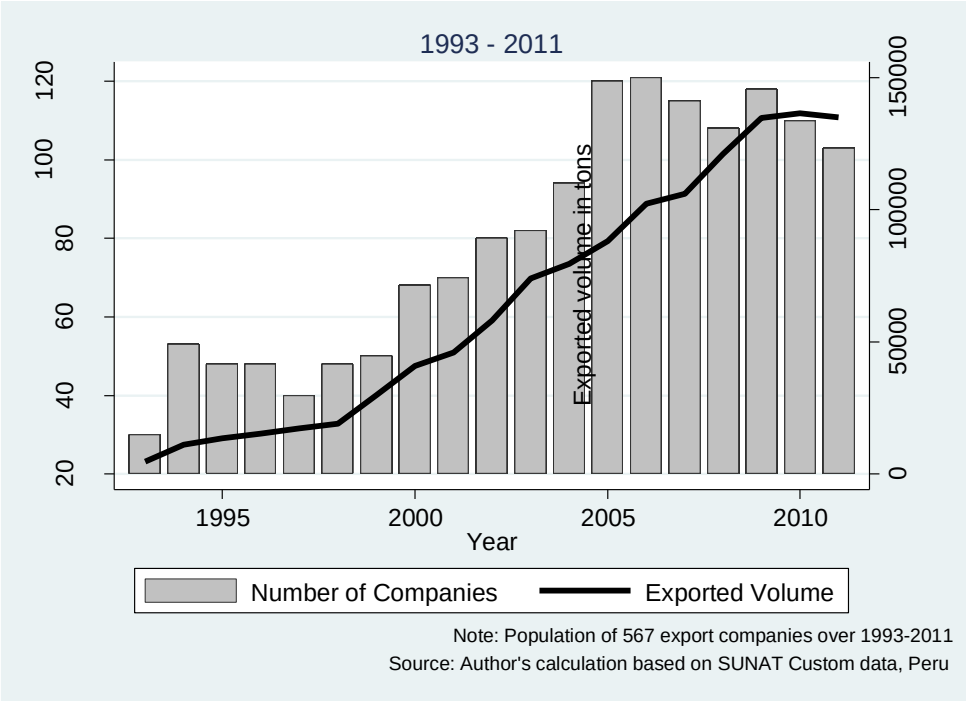
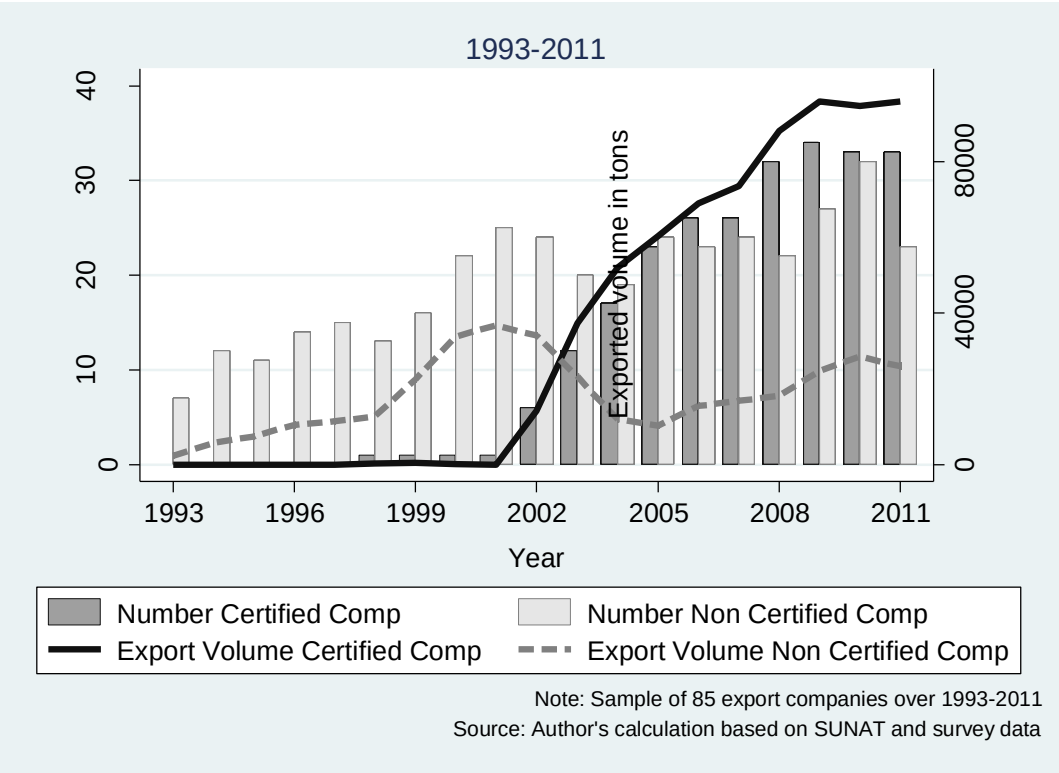
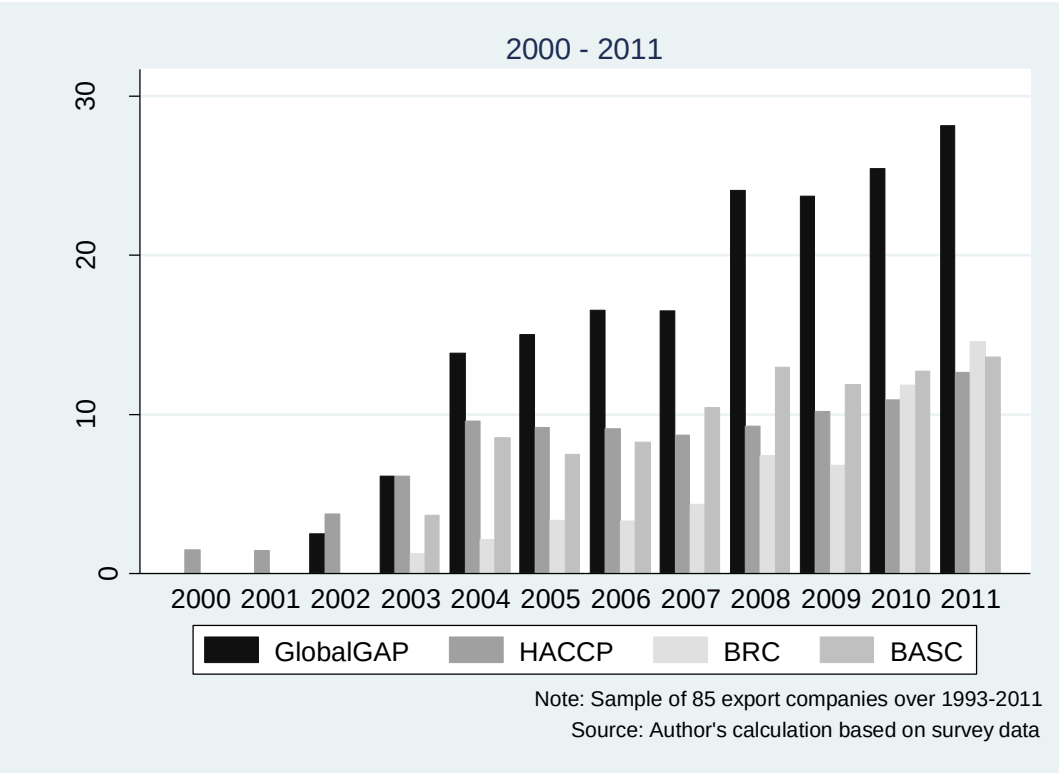


Figure 3: **Evolution of certified and non-certified fresh asparagus export volumes and the number of certified and non-certified export companies, Peru, 1993 - 2001**



Note: Sample of 85 export companies over 1993-2011
Source: Author's calculation based on SUNAT and survey data

Figure 4: **Share of companies certified to main private standards**



Note: Sample of 85 export companies over 1993-2011
Source: Author's calculation based on survey data

Table 1: Description of company variables used in regression analysis

Variables	Description	Time varying variable
Export Volume	Exported volume in metric tons (mt)	yes
Certification (*)	=1 if certified to any type of food standard	yes
Nb Certificates (*)	Number of food standard certifications held	yes
Years Certified	Number of years company has been certified	yes
Asparagus Land Dummy	=1 if cultivates asparagus land	yes
Asparagus Land Ha (*)	Hectars of cultivated asparagus land	yes
Processing Plant (*)	=1 if owns a processing plant	yes
Trader (*)	=1 if not owning land nor processing plant	yes
Years Exist	Number of years since foundation	yes
Years Exporting	Number of years since first fresh asparagus export	yes
Foreign Capital (*)	=1 if owned by foreign capital	yes
Green Asparagus	% of green (with respect to white) asparagus exported	yes
Double Tax ID(*)	=1 if company exports with >1 tax identification number	yes
Admin Change	=1 if change of administrative staff (manager/president)	yes
Org Change(*)	=1 if organizational change in company	yes
Taxpayer Regime	=1 if affiliated to favoured taxpayer regime	yes
Taxpayer Good	=1 if classified as good taxpayer by national tax entity	yes
Agriculture core business	=1 if agriculture is the core business	no
Nb Prod Quarters	Number of production quarters	no
Nb Admin Quarters	Number of administrative offices	no
Non Agric Capital(*)	=1 if starting capital comes from non agricultural business	no
Export Pioneer	=1 if company has been exporting in year<2003	no
Ancash	=1 if company operates in the Ancash region	no
Ica	=1 if company operates in the Ica region	no
La Libertad	=1 if company operates in La Libertad region	no
Lima	= if company operates in the Lima region	no

(*) Data from own survey on stratified random sample

Table 2: Summary statistics of main company characteristics, 2000 versus 2011

Variables	All companies in 2000			All companies in 2011		
	Mean	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**	**Obs**
Export Volume (in mt)	608.710	1037.440	67	1323.453	2497.296	102
Certification (*)	0.032	0.179	25	0.309	0.466	60
Nb Certificates (*)	0.064	0.359	25	0.966	1.758	60
Years Certified (*)	0.183	0.667	21	2.042	3.600	54
Asparagus Land Dummy (*)	0.456	0.511	20	0.446	0.502	55
Asparagus Land Ha (*)	10.499	19.033	20	16.913	42.073	55
Processing Plant (*)	0.426	0.505	25	0.427	0.499	61
Trader (*)	0.255	0.446	25	0.442	0.501	59
Years Exist	5.239	2.641	67	8.078	6.218	102
Years Exporting	3.149	2.613	67	6.363	5.556	102
Export Pioneer	1.000	0.000	67	0.284	0.453	102
Foreign Capital (*)	0.217	0.420	26	0.354	0.482	61
Green Asparagus (*)	94.866	18.816	27	94.772	19.649	62
Ancash	0.074	0.267	67	0.032	0.178	102
Ica	0.667	0.480	67	0.548	0.502	102
La Libertad	0.074	0.267	67	0.274	0.450	102
Lima	0.148	0.362	67	0.129	0.338	102

(*) Data from own survey of stratified random sample. Sample means are weighted for the population average to control for the oversampling of consolidated and intermediate companies

Table 3: Summary statistics of company characteristics, certified versus non-certified companies, 2011

Variables	Certified companies in 2011 (N=33)		Non Certified companies in 2011 (N=27)	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
Export Volume in 2003 (*)	2359.408	2327.091	70.282	75.478
Export Volume in 2005 (**)	2373.274	2369.110	351.955	346.310
Export Volume in 2011	2903.134	3273.755	959.796	1960.686
Yearly growth in mt 2000-2011	163.151	817.450	49.265	319.695
Nb Certificates	3.126	2.364	0.000	0.000
Years Certified	7.155	4.331	0.000	0.000
Asparagus Land (Dummy)	0.964	0.256	0.251	0.359
Asparagus Land (Ha)	55.173	91.576	2.800	6.019
Processing Plant	0.876	0.443	0.233	0.344
Trader	0.000	0.000	0.644	0.388
Years Exist	13.792	5.912	5.833	3.254
Years Exporting	11.084	6.806	3.175	2.135
Export Pioneer	0.644	0.644	0.026	0.130
Foreign Capital	0.459	0.671	0.312	0.377
Green Asparagus	85.819	41.383	98.927	5.120
Ancash	0.059	0.316	0.000	0.000
Ica	0.694	0.620	0.597	0.399
La Libertad	0.189	0.527	0.299	0.373
Lima	0.029	0.227	0.104	0.248

Note: All sample means are weighted for the population average to control for the oversampling of consolidated and intermediate companies; (*) Number of companies that were exporting in 2011 and in 2003: N=25, of which 'certified comp'.: N=20, 'Non certified comp'.:N=5; (**) Number of companies that were exporting in 2011 and in 2005:N=34, of which 'certified comp'.:N=26, 'Non certified comp'.:N=8

Table 4: Regression results with certification dummy as main explanatory variable

	OLS	OLS	FE	Sys-GMM	Sys-GMM
	(1)	(2)	(3)	(4)	(5)
Certification dummy	2.445**	0.825	0.823	1.021	0.879
	(1.043)	(0.531)	(0.724)	(0.740)	(0.693)
Export volume(t-1)		0.640***	0.389***	0.578***	0.584***
		(0.041)	(0.050)	(0.061)	(0.061)
Processing plant	3.418***	1.422***	2.062***	2.115**	2.296***
	-0.817	(0.477)	(0.656)	(1.059)	-0.878
Asparagus land[(a)]	0.104***	0.045***	0.105***	0.049*	0.055**
	(0.030)	(0.017)	(0.025)	(0.029)	(0.025)
Asparagus land2[(a)]	-0.000***	-0.000***	-0.000***	-0.000*	-0.000**
	0.000	0.000	0.000	0.000	0.000
Years exist	-1.278***	-0.773***	-1.487***	-1.573***	-1.396***
	(0.297)	(0.187)	(0.304)	(0.279)	(0.275)
Years exist2	0.032*	0.024***	0.032***	0.064***	0.053***
	(0.017)	(0.009)	(0.011)	(0.015)	(0.015)
Years exporting	1.404***	0.159	-0.517*	0.647***	0.557***
	(0.251)	(0.144)	(0.279)	(0.216)	(0.211)
Years exporting2	-0.067***	-0.009	-0.015	-0.036***	-0.029**
	(0.014)	(0.008)	(0.012)	(0.012)	(0.012)
Green Asparagus (%)	0.035**	0.011	-0.05	-0.027	-0.014
	-0.016	-0.008	(0.093)	(0.042)	-0.035
Double Tax ID	3.421***	1.307**	1.436**	1.238**	1.240**
	(0.635)	(0.520)	(0.564)	(0.587)	(0.624)
Organizational Change	3.787***	2.273**	1.393	1.865	1.631
	(1.352)	(0.892)	(1.055)	(1.156)	(1.029)
Admin staff change	-0.466	0.411	0.07	0.074	0.014
	(0.567)	(0.811)	(0.784)	(0.675)	(0.702)
Foreign capital	-0.468	-0.128	3.075***	1.169	0.729
	(0.713)	(0.416)	(0.913)	(1.861)	(1.588)
Taxpayer regime	1.952*	0.874	-0.136	1.245	1.178
	(0.993)	(0.537)	(0.920)	(0.867)	(0.775)
Taxpayer "good"	4.066***	1.288**	0.543	2.557***	2.770**
	(0.963)	(0.644)	(1.373)	(0.915)	(1.095)
Agriculture core business	-1.192	-0.393			
	(0.787)	(0.391)			
Nb production sites	0.405*	0.15			
	(0.234)	(0.113)			
Nb administrative sites	-1.197***	-0.489**			
	(0.418)	(0.233)			
Non agric capital	-0.864	0.114			
	(0.729)	(0.423)			
Export pioneer	0.888	0.913			
	(1.229)	(0.641)			
Constant	0.612	3.201*	5.128	8.102**	6.524**
	(2.281)	(1.625)	-8.238	-3.97	(3.310)
Year Dummies	yes	yes	yes	yes	yes
Location Dummies	yes	yes	-	-	-
R 2	0.455	0.665	0.729		
N	761	691	691	691	691
Number of collapsed IV's				62	76
2nd order autocorrelation				0.095	0.098
Hansen test: overid restrictions (p-value)				0.235	0.574
Difference Hansen test (p-value)				0.441	0.505

Company cluster robust standard errors in parenthesis for the OLS and FE estimations. Robust finite samples corrected standard errors (Windmeijer, 2005) in parenthesis for the System GMM; *** p<0.01, ** p<0.05, * p<0.1; (a) divided by 10 hectares

Table 5: Regression results with number of certificates as main explanatory variable

	OLS	OLS	FE	Sys-GMM	Sys-GMM
	(1)	(2)	(3)	(4)	(5)
Number of Certificates	1.815**	0.598*	0.368	0.640	0.555
	(0.785)	(0.358)	(0.448)	(0.478)	(0.458)
Number of Certificates2	-0.262**	-0.105*	-0.076	-0.103	-0.079
	(0.120)	(0.053)	(0.089)	(0.083)	(0.077)
Export volume(t-1)		0.654***	0.395***	0.585***	0.589***
		(0.038)	(0.049)	(0.061)	(0.060)
Year Dummies	yes	yes	yes	yes	yes
Location Dummies	yes	yes	-	-	-
Company covariates	yes	yes	yes	yes	yes
R 2	0.416	0.664	0.728		
N	761	691	691	691	691
Number of collapsed IV's				65	80
2nd order autocorrelation				0.086	0.084
Hansen test: overid restrictions (p-value)				0.290	0.644
Difference Hansen test (p-value)				0.352	0.460

Company cluster robust standard errors in parenthesis for the OLS and FE estimations. Robust finite samples corrected standard errors (Windmeijer, 2005) in parenthesis for the System GMM; *** p<0.01, ** p<0.05, * p<0.1

Table 6: Regression results with number of years certified as main explanatory variable

	OLS	OLS	FE	Sys-GMM	Sys-GMM
	(1)	(2)	(3)	(4)	(5)
Years Certified	0.543**	0.180*	0.128	0.125	0.135
	(0.232)	(0.097)	(0.156)	(0.155)	(0.142)
Export volume(t-1)		0.668***	0.406***	0.601***	0.604***
		(0.039)	(0.051)	(0.065)	(0.065)
Year Dummies	yes	yes	yes	yes	yes
Location Dummies	yes	yes	-	-	-
Company covariates	yes	yes	yes	yes	yes
R 2	0.41	0.668	0.731		
N	697	633	633	633	633
Number of collapsed IV's				62	76
2nd order autocorrelation				0.102	0.101
Hansen test: overid restrictions (p-value)				0.425	0.892
Difference Hansen test (p-value)				0.557	0.876

Company cluster robust standard errors in parenthesis for the OLS and FE estimations. Robust finite samples corrected standard errors (Windmeijer, 2005) in parenthesis for the System GMM; *** p<0.01, ** p<0.05, * p<0.1

Table 7: Regression results, excluding trading companies (N=67)

	OLS (1a)	OLS (2a)	FE (3a)	Sys-GMM (4a)	OLS (1b)	OLS (2b)	FE (3b)	Sys-GMM (4b)	OLS (1c)	OLS (2c)	FE (3c)	Sys-GMM (4c)
Certification dummy	2.545**	0.696	-0.265	0.733								
	(1.165)	(0.563)	(0.741)	(0.863)								
Number of Certificates					1.614*	0.453	-0.158	0.338				
					(0.917)	(0.394)	(0.468)	(0.416)				
Number of Certificates2					-0.197	-0.056	0.051	-0.053				
					(0.135)	(0.056)	(0.083)	(0.086)				
Years Certified									0.572**	0.203*	0.12	0.112
									(0.276)	(0.104)	(0.182)	(0.191)
Export volume(t-1)		0.657***	0.376***	0.582***		0.659***	0.373***	0.596***		0.677***	0.401***	0.604***
		(0.049)	(0.071)	(0.088)		(0.049)	(0.071)	(0.085)		(0.048)	(0.070)	(0.094)
Year Dummies	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Location Dummies	yes	yes	-	-	yes	yes	-	-	yes	yes	-	-
Company covariates	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
R 2	0.393	0.651	0.733		0.387	0.65	0.716		0.382	0.658	0.716	
N	524	502	502	502	524	502	502	502	475	454	454	454

Company cluster robust standard errors in parenthesis for the OLS and FE estimations. Robust finite samples corrected standard errors (Windmeijer, 2005) in parenthesis for the system GMM; *** p<0.01, ** p<0.05, * p<0.1; Column (4), (9) and (14): lags t-1 to t-3 for predetermined, t-2 to t--3 for endogenous variables; Second order autocorrelation in the GMM estimates is rejected at the 10% level. The null hypothesis of valid instruments' specification is accepted at the 10% level with the Hansen test of over-identification restrictions and the Difference Hansen test