Journal *of* African Development 2017, 19(1):61–83

Management Standard Certification and Firm Productivity: Micro-evidence from Africa

Micheline Goedhuys and Pierre Mohnen

Abstract

Using micro evidence from manufacturing and services firms located in 41 African countries, this paper shows that better management practice, reflected by international management certification, helps firms to raise productivity. Larger and older firms and firms operating closer to the technological frontier are more likely to possess international management standards certification, as do firms engaged in international transactions. Certification in turn raises productivity levels further, in line with a process of continuous improvement. The findings hold for both manufacturing and services firms.

Keywords: Management Standards, ISO, Productivity, Africa, Manufacturing, Services

JEL Classification: D02, D24, L15, O33, O55

1. Introduction

In recent years, standards have gained more and more weight in international trade and the governance of global value chains. Various types of standards exist. Some define technical specificities for products. Others are generic process standards for best-practice management systems and provide a model to follow when setting up and operating a management system in line with specific targets. For instance, the most widely diffused and adopted management standards are those developed by the International Organization for Standardization (ISO), and known as the ISO 9000 and ISO 14000 standards. ISO 9000 contains standards for quality management systems aimed at satisfying customer requirements. ISO 14000 is specific for environmental management systems and prescribes management standards to minimize the

Micheline Goedhuys, UNU-MERIT, Boschstraat 24; 6211 AX Maastricht, Netherlands, Goedhuys@merit.unu.edu (Corresponding author)
Pierre Mohnen, Maastricht University, UNU-MERIT, Boschstraat 24; 6211 AX Maastricht, Netherlands

negative effects of firms' operations on the environment. Addressing issues of Corporate Social Responsibility, internationally agreed standards for working conditions also exist, which firms can voluntarily implement by way of self-regulation.

Under pressure of activist groups, consumer organisations and other stakeholders, firms active in global markets increasingly rely on these standards to protect their corporate reputation, control suppliers and coordinate international production (Pietrobelli and Rabelotti, 2011; Kaplinsky, 2010). Lead firms in global value chains therefore require from local suppliers in developing countries a demonstrated commitment to quality, environmental sustainability and decent labour conditions. This commitment takes the form of a management certificate demonstrating implementation and adherence to the respective internationally agreed management standards. It commonly requires that the firms' management system is audited, on a regular basis, by an accredited certification body, which issues a certificate of conformity if the requirements of the standards are met.

This trend clearly has implications for the development of local producers in developing countries. Some scholars argue that for LDC countries standards act as a barrier to entry into global markets and add to the cost of doing business (Martinez and Poole, 2004; Unnevehr, 2000) especially for small scale producers. By contrast, others argue that certification reduces transaction costs and acts as catalysts for innovation and technological learning, facilitating upgrading to higher value niches in the value chain. Case studies on global value chains in different industries provide support for the latter (e.g. Albornoz et al. 2002, Quadros, 2004, Nadvi and Waltring, 2004, Jaffee and Henson, 2005). There is an ongoing debate among policy makers and researchers understanding the mechanisms and effects of standards on firm performance

This interest stands in sharp contrast to the patchy evidence on the effects of management standards for firms in developing countries. Most empirical papers on standards and development focus on the effect of *product* standards, mostly fresh produce, on exports (e.g. Henson et al. 2011, Maertens and Swinnen, 2009, Gebreeyesus, 2014). *Management* standards by contrast are broader generic standards providing a model to follow when setting up and operating a management system aimed at reaching predefined targets. Hence, the adoption of management standards reveals good management capabilities and practice in place and can serve as a measure of management capability (Iizuka, 2009). Both the effect of management practice and the effect of management certification are poorly documented for developing country firms. For Africa, Fikru (2014b) studies the adoption determinants of Ethiopian firms. He shows that not only pressure from international laws and multinationals affect certificate adoption, but also national actors, such as government and worker unions call for standards that create a safe work environment. Goedhuys and Sleuwaegen (2013) pool data from various developing countries and find that certification is important for productivity and firm growth, especially in institutionally weak countries.

To address this caveat and to contribute to this emerging debate on the role of management standards for developing country firms, this paper takes the analysis to the level of the firm and evaluates whether an empirical basis exists for inferring a productivity enhancing effect from international management certification for African producers. We take advantage of the availability of micro evidence from the World Bank Enterprise Surveys (WBES) to investigate the determinants of international management certificate (IMC) adoption, and its further impact on the productivity of firms. We use firm level data from 41 Sub-Saharan African countries to address the following questions: what are the characteristics of the firms that have obtained an IMC? Does IMC lead to superior productivity levels, suggesting effective implementation of management best practices and superior technology adoption? Since conceptually one can identify firm specific factors that affect both adoption and firm productivity, we estimate an endogenous treatment-regression model for our cross section data.

This study complements an empirical literature that has largely focused on the effect of

certification on the performance of firms in leading developed nations on the one hand, and a literature that has studied the impact of standards on the evolution of industries in developing countries on the other hand. It takes the firm as unit of analysis, presents original evidence on the decision to adopt management certification in Africa and investigates econometrically its effect on the productivity of firms. By selecting productivity as the performance indicator, the study adds to the debate on how to raise productivity levels in Sub-Saharan African (SSA) countries, needed for structural transformation of the economies to high-value activities. The productivity study is linked to an indicator of management practice, which is a relatively understudied relationship as compared to institutional constraints and financial market failures and has only recently started to get attention in the literature (Bloom et al., 2010, 2011; Bloom and Van Reenen, 2007). The study is conducted for manufacturing firms and services firms separately, thereby providing unique evidence of the effect of standards in the increasingly important services industries.

The paper is structured as follows. Section two elaborates on the literature that documents the various benefits which standards accreditation can entail and formulates some hypotheses for testing. Section three presents the data and the empirical methodology. Section four presents the results. Section five discusses the findings from a policy perspective and advances some important avenues for further research in this area.

2. Adopting and Sustaining Certification: Literature and Hypotheses

2.1. Theoretical Framework

Management standards provide internationally agreed expert knowledge regarding generic best-practice management systems and as such they are an invaluable source of technical knowledge and an important channel for technology diffusion and transfer worldwide as firms can access easily the conditions and requirements of the standard. Standards are not limited to manufacturing. More recently, also in the services sector, market demand for standards to ensure quality of service delivery is on the rise. The number of standards related to services—such as financial services, tourism, transport or services for consumers—is growing rapidly (ISO, 2016).

With this trend, a literature developed in international business studies and business strategy, examining the motivations for firms to obtain certification and the advantages certification provide for the performance of the firm. Most studies focus on ISO9000 certification and (to a somewhat lesser extent) ISO14000 certification, which was more recently developed. Although the various standards have their own specific objectives, the motivations to obtain certification and the benefits provided appear to be largely the same (Pan, 2003; Poksinska et al., 2003) and their international diffusion process follows similar patterns (Viadiu et al., 2006).

Recent studies contend that in deciding whether to seek accreditation, firms balance the cost of going through the certification procedure against the possible benefits the certificate can provide (Henson et al., 2011;Goedhuys and Sleuwaegen, 2013; Gebreeyesus, 2014).

Costs related to accreditation can be high. Seeking certification of management standards is complex because it typically involves the documentation of procedures involved throughout the production process rather than measuring a single outcome (as in the case of a product). In particular, the ISO9000 and ISO14000 series of standards require the documentation of practices and outcomes at various stages of the production process. Unlike product standards, management standards do not set the levels which must be achieved, but only require that these levels be checked and documented (Kaplinsky, 2010). Hence, the management system has to be documented and codified, evaluated and adapted, and local firms need to hire

specialised suppliers and private consultancy firms to assist them in the process and to deliver the certificate. For smaller firms in developing countries, the efforts and associated costs for firms to obtain certification are considered a serious hindrance, especially for smaller firms that do not have the complementary resources and competences to easily reach the standard (Czubala et al., 2009).

Clearly, the efforts and costs are higher for firms with management practices far below world standards and a need of substantial upgrading. Hence the adherence to international management standards and certification are conditional upon the access to valuable resources, on the one hand, and the development of important complementary firm-specific capabilities. This brings to the forefront the large body of research that explores technological capabilities and technological learning in firms of developing countries and builds on insights from early works by Fransman (1985), Lall (1992) and others. Technological capabilities refer to the efforts and activities that individual enterprises undertake to absorb knowledge and build upon their existing knowledge, in a process that involves investment and risk taking. This also applies to the absorption of knowledge codified in management standards, which entail investment and technological learning.

These costs of certification are balanced against the expected benefits. Conceptually two types of benefits are distinguished (Sampaio et al., 2009). First, studies have revealed that in the process of applying for certification, firms realise important operational improvements from analysing, evaluating, adjusting and codifying the process of production and distribution of goods and services. These are called 'internal' benefits and can take the form of increased output, higher quality, reduced waste, improved working conditions and work hazard reduction, higher levels of customer satisfaction and so on. But also once the certificate is obtained, the standards provide mechanisms for further performance improvements (Corbett, Montes-Sancho, Kirsch, 2005). This is due to the fact that standards are based on continuous improvements sustained by the periodicity of the audits upon which the certification remains conditional.

Second, 'external benefits' from certification are also identified, as firms use the certificate strategically to 'signal' to potential contracting parties that the firm is a high-performer on quality management issues (Terlaak and King, 2006). When information asymmetries are likely to exist between sellers and buyers, the possession of an international management certificate can be instrumental in reducing transaction costs. This is mainly the case when client firms and other business partners lack information or fear opportunism by the supplier (King, et al., 2005); in industries where intangibles such as R&D and advertising are important – industries thus where buyers have greater difficulty acquiring information about suppliers (Terlaak and King 2006); in industries and firms that use risky technologies (Blind and Hipp 2003), when a firm's potential buyers are more distant and located in foreign countries (King, et al., 2005). Physical but also social, cultural, and institutional distance may increase information asymmetry and reduce information transfer, in which case a certificate may improve corporate reputation, open up market opportunities, facilitate insertion in global value chains and raise the competitiveness of the firm.

2.2. Hypotheses

a. Determinants of certificate adoption

Empirically, the factors determining adoption of standards are, in line with the framework developed above, those factors that affect the expected cost and benefit of accreditation.
Many studies identify *firm size* as a first dimension affecting the cost of certification. As

explained earlier, the certification process is expensive, and this is relatively more a burden to small firms that do not have the scale of operations to recover the investment (Kaplinsky, 2010). For developing countries Goedhuys and Sleuwaegen (2013), Gebreeyesus (2014) and Fikru (2014b) find indeed that the likelihood of having management certificate increases with firm size.

The cost and effort of certification are also less high for firms which, prior to certification, are implementing practices closer to world standards and operating closer to the technological frontier. Firms with less professional management systems on the contrary will need to invest more heavily. In this context, Fikru (2014a) and Goedhuys and Sleuwaegen (2013) find that firm capabilities are important determinants of the ability of firms in developing countries to obtain international standards certification. Similarly, as learning and competence building take place over time, older firms are likewise better endowed with financial resources and human capital needed for standards certification.

In line with the resource-based view of the firm which views the firms as a unique bundle of resources (Peteraf, 1993), allowing for large heterogeneity of firms within industries and countries, and considering the cost differentials in obtaining certification, we test the following hypothesis:

H1: Larger and older firms, better endowed firms and firms operating closer to the technological frontier are more likely to have a management certificate.

But there are also factors influencing the expected benefits. Firms investing more heavily in the absorption and implementation of international standards, with more substantial managerial upgrading are likely to have more internal productivity gains (Sampaio et al., 2009). But also the signalling role of the certificate changes the expected return from investment. Firms involved in more complex international transactions, such as those in global value chains, serving global markets or sourcing technology and inputs from abroad, are likely to benefit more from accreditation. While Fikru (2014b) finds that domestic pressure also influences the likelihood that a firms adopts international standards, the expected transaction cost reducing effect is likely to be higher when firms serve geographically, culturally and institutionally more distant clients and suppliers.

We therefore hypothesise that:

H2: Firms engaged in international transactions are more likely to have a management certificate

b. Certificate adoption and firm performance

The central focus of this paper is to investigate the further impact of certification on firm performance. Studies using panel data from firms from developed countries use a variety of performance indicators and find indeed positive outcomes such as significant abnormal returns and improved financial performance in the period after certification (e.g. Corbett, Montes-Sancho and Kirsch (2005), Casadesús and Gimenez (2000) for Spanish firms, Turner, Ortmann and Lyne (2000) for South African firms). Conclusive evidence that financial performance improves after certification is derived from these studies. Dunu and Ayokanmbi (2008) have indications that revenue and income improve after ISO 9000 certification, but the effect vanishes when other indicators are used.

Evidence is also found at the macro and meso levels that standards stimulate international trade (Swann, Temple, Shurmer, 1996). At the firm level, Bellesi, Lehrer and Tal (2005) find a positive impact of ISO 14001 on exports. They argue that besides price and quality, clients in

Europe are concerned about environmental and management issues, raising the importance of ISO 14001 certificates for exporting. The certificate thus increases the probability that a firm exports, in addition, to the usual determinants like size, productivity, capital intensity, human capital, innovation and R&D (Wagner 2006).

From theoretical insights and empirical findings, it can be expected that firms operating in Africa are likely to experience a strong positive influence from certification. Certification in the first place requires firms to raise their operational efficiency and meet a wide range of management system requirements. In addition, weak institutional environments and poor rule of law can strengthen the role of standards as a substitute instrument to guarantee enforcement of contracts and commitments. In this context, using macro trade data, Clougherty and Grajec (2008) show that ISO diffusion has a positive effect on exports in developing countries, yet no effect in developed countries. Goedhuys and Sleuwaegen (2013) explicitly tested the impact of certification on productivity and firm growth in countries at various levels of development. They found productivity gains to be substantial, especially in weakly developed countries and argue that the implementation of standards, that are considered basic in more advanced economies, are for developing country firms a mechanism to improve efficiency and engage in technological learning. Given our sample of African firms, we focus on this encompassing indicator of performance and test the following hypothesis:

H3: *Firms with a management certificate reach higher levels of productivity, all else equal.*

Some authors (e.g. Fikru 2014a) do not find certification to substantially and significantly improve performance. The absence of an effect of certification on performance could be due to the fact firms can realise important productivity gains without applying for a certificate. But it is also likely that more efficient firms have a greater propensity to apply for certification (Heras et al., 2002), making the further performance improvements resulting from certification more limited. Clearly, these effects require an estimation strategy that explicitly takes into account the possibility of reversed causality and observable and unobservable factors jointly affecting adoption and firm performance (see next section).

In the next section we investigate empirically the importance of certification for the productivity of firms in Sub-Saharan Africa. We examine the determinants of management certification and test whether international management certification is associated with superior productivity levels.

3. The Extent of Management Certification in some Sub-Saharan African Countries

We use data from the World Bank Enterprise Surveys, which are conducted worldwide and provide unique micro-data from African companies. The surveys are an important source of firm-level information on the factors affecting the performance of firms in LDC countries. For the purpose of our analysis it contains information on certification, technological efforts by firms and some historical data that allow developing productivity performance indicators, both current and lagged.

The samples of firms in the ICS are drawn from the business register following a stratified random sampling based on location, size and industry. Because the distribution of establishments in most countries is mostly populated by small and medium enterprises, surveys generally over-sample large establishments. For more details on the sampling, see WBES Methodology (http://www.enterprisesurveys.org/Methodology, 2014)

The WBES are conducted in a harmonised manner, yet the survey instrument (questionnaire)

varies with the industries being surveyed. Hence, there exists a survey for manufacturing firms, but there is also a questionnaire for services firms and retail and IT firms, with a slightly different set of questions. As services are also in African countries increasingly important in terms of share of GDP and with ICT clusters emerging in various African countries, we have chosen not to limit ourselves to manufacturing firms alone, but decided to integrate the data from the other surveys as well, as much as possible. We do our estimations for manufacturing and non-manufacturing (services) firms separately, as some indicators and variables are not uniformly available for both groups.

The surveys were not all conducted in the same year in the various African countries. We have chosen the last available wave for each country, and hence survey years range from 2006 until 2014. Taking this approach we were able to use a cross section of firm data from 41 African countries.

A number of firms dropped out because they had missing information on variables crucial to our analysis. The final sample consists of 3466 firms in manufacturing and 5148 services firms. Of these, 19% and 15% of the surveyed firms in manufacturing and services respectively have an internationally accepted management certificate. The sample is presented in table 1. The mean (median) size of the firms in our sample is 69 (17) employees in manufacturing and 39 (11) employees in services.

Industry wise the distribution of firms is presented in table 2. The table also contains

Table 1. Composition of the sample, by country and industry.

	Survey year	TOTAL Sample	manufacturing			Services & IT		
			N	# IMC	% IMC	N	# IMC	% IMC
Nigeria	2007	1531	775	73	0.09	756	51	0,07
SouthAfrica	2007	788	573	229	0.40	215	40	0,19
Kenya	2013	446	187	58	0.31	259	62	0,24
Ghana	2007	417	245	16	0.07	172	3	0,02
Zambia	2013	366	125	25	0.20	241	38	0,16
Senegal	2007	364	193	14	0.07	171	13	0,08
Mozambique	2007	350	233	34	0.15	117	45	0,38
Ethiopia	2011	291	69	13	0.19	222	30	0,14
Cameroon	2009	289	72	21	0.29	217	42	0,19
Madagascar	2009	259	113	12	0.11	146	13	0,09
BurkinaFaso	2009	249	29	6	0.21	220	36	0,16
Ivory Coast	2009	235	78	4	0.05	157	8	0,05
Angola	2010	189	60	12	0.20	129	23	0,17
Namibia	2006	186	69	25	0.36	117	27	0,23
Uganda	2013	184	49	12	0.24	135	18	0,13
Mauritius	2009	180	54	11	0.20	126	19	0,15
DRC	2010	175	65	6	0.09	110	13	0,12
Swaziland	2006	175	47	13	0.28	128	28	0,22
Burundi	2006	173	76	4	0.05	97	6	0,06
Botswana	2010	166	43	9	0.21	123	26	0,21

Table 1. (*continued*).

	Survey year	TOTAL Sample	manufacturing			Services & IT		
			N	# IMC	% IMC	N	# IMC	% IMC
Mauritania	2006	149	68	5	0.07	81	2	0,02
Guinea	2006	140	77	5	0.06	63	3	0,05
Tanzania	2013	134	38	6	0.16	96	25	0,26
Zimbabwe	2011	119	67	25	0.37	52	8	0,15
Gambia	2006	98	21	4	0.19	77	20	0,26
Rwanda	2011	94	0	0	-	94	11	0,12
GuineaBissau	2006	89	30	2	0.07	59	2	0,03
Sierra Leone	2009	79	0	0	-	79	19	0,24
Centralafricanrepub..	2011	73	0	0	-	73	26	0,36
Liberia	2009	70	0	0	-	70	4	0,06
Chad	2009	65	0	0	-	65	31	0,48
Lesotho	2009	60	0	0	-	60	18	0,30
Gabon	2009	59	0	0	-	59	12	0,20
Togo	2009	59	0	0	-	59	9	0,15
Mali	2010	56	10	2	0.20	46	14	0,30
Malawi	2009	52	0	0	-	52	14	0,27
Niger	2009	50	0	0	-	50	2	0,04
CapeVerde	2009	48	0	0	-	48	9	0,19
Benin	2009	41	0	0	-	41	2	0,05
Eritrea	2009	39	0	0	-	39	8	0,21
Congo	2009	27	0	0	-	27	6	0,22
Total		8,614	3,466	646	0.19	5,148	786	0,15

the proportion of firms having a management certificate (IMC), the proportion of firms that exported three years prior to the survey, and the average number of employees, to give an indication of the size of firms by industry. The most important industries, reflected in terms of sample representation, are food products and beverages, textiles and apparel and metal products, all with IMC incidences close to 18%, the average of manufacturing. In services, large industry representation is found in retail and wholesale, hotels and restaurants, where IMC incidence are relatively low; followed by construction, maintenance of vehicles, computer and related activities and transportation services (ISIC 60-64), where the incidence of IMC are relatively higher.

4. Certification and Productivity: the Econometric Model

Following the discussion in section 2, our main interest lies in the nature of the relationship between certification and firm productivity. Ideally, with panel data and information on the year in which the company obtained its (first) certificate, one would perform an analysis that tracks the evolution of productivity before and after certification. Unfortunately, this is not the

Table 2. Descriptive statistics.

ISIC code	N	% IMC	% of exporting firms in T = 0	Mean empl.
Manufacture of:				
15 - food products and beverages	868	20.3	12.2	92
16 - tobacco products	5	60.0	40.0	281
17 - textiles	103	19.4	36.9	138
18 - wearing apparel; dressing and dyeing of fur	583	7.4	15.3	48
19 - Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	76	10.5	27.6	49
20 - wood and of products of wood and cork, except furniture; articles of straw and plaiting materials	135	14.1	19.3	57
21 - paper and paper products	39	30.8	25.6	88
22 - Publishing, printing and reproduction of recorded media	140	12.9	8.6	40
23 - coke, refined petroleum products and nuclear fuel	5	40.0	80.0	181
24 - chemicals and chemical products	216	42.6	27.8	86
25 - rubber and plastics products	108	33.3	26.9	99
26 - other non-metallic mineral products	132	19.0	11.4	54
27 - basic metals	54	14.8	11.1	44
28 - fabricated metal products, except machinery and equipment	371	18.9	13.8	66
29 - machinery and equipment n.e.c.	84	39.3	34.5	76
30 - office, accounting and computing machinery	2	0.0	0.0	11
31 - electrical machinery and apparatus n.e.c.	44	38.7	31.8	83
32 - radio, television and communication equipment and apparatus	11	36.4	54.6	204
33 - medical, precision and optical instruments, watches and clocks	3	66.7	33.3	84
34 - motor vehicles, trailers and semi-trailers	18	22.2	5.6	255
35 - other transport equipment	11	27.3	27.3	71
36 - furniture; manufacturing n.e.c.	456	11.0	7.9	23
37 – Recycling	2	50.0	100.0	1816
Total manufacturing	3,466	18.6	16.19	69
45 – Construction	572	16.43	2.45	71
50 - Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	428	18.46	8.18	32
51 - Wholesale trade and commission trade, except of motor vehicles and motorcycles	620	16.29	8.87	50
52 - Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	2,077	12.33	3.80	30
55 - Hotels and restaurants	959	13.66	3.34	24
60 - Land transport; transport via pipelines	123	29.27	15.45	85
61 - Water transport	15	46.67	46.67	153
62 - Air transport	18	50.00	27.78	88

Table 2. (*continued*).

ISIC code	N	% IMC	% of exporting firms in T = 0	Mean empl.
63 - Supporting and auxiliary transport activities; activities of travel agencies	68	27.94	27.94	75
64 - Post and telecommunications	32	34.38	6.25	158
72 - Computer and related activities	207	17.39	3.86	18
Other services	29	21.74	8.70	42
Total services	5,148	15.27	5.42	39

case in our African sample, and we are confined to work on cross section data.

To account for a simultaneity bias that may arise from the fact that more efficient firms are likely to gain accreditation, we estimate an endogenous treatment-regression model, also known as an endogenous binary-variable model or as an endogenous dummy-variable model, introduced in the literature by Heckman (1979) and further discussed by Wooldridge (2010). The endogenous binary-variable model is a linear potential-outcome model that allows for a specific correlation structure between the unobservables that affect the treatment (certification) and the unobservables that affect the potential outcomes (productivity).

The endogenous treatment-regression model is composed of an equation for the outcome $y_{j,}$ here productivity, and an equation for the endogenous treatment, the incidence of having a management certificate, t_j. In our particular case, the outcome equation is modeled as a log-linear Cobb-Douglas production function, explaining productivity (y_j) of firm j as a function of its capital stock (k_j) and employment (l_j). 'A' characterizes total factor productivity (tfp_j).

$$y_j = A\ (t_j, z_j)\ k^a_j\ l^\beta_j\ e^{\varepsilon j}$$

Taking logarithms, rewriting the equation in terms of labour productivity, and allowing for persistence in labour productivity, the estimating equation becomes:

$$\ln(y_j/l_j) = \gamma \ln(y_{j-1}/l_{j-1}) + \ln A(t_j, z_j) + \alpha \ln(k_j/l_j)\ 1\ (\alpha + \beta - 1)\ln l_j + \varepsilon_j \qquad (1)$$

$$t_j = 1 \ \text{ if } w_j\gamma + u_j > 0 \text{ and } = 0, \text{ otherwise} \qquad (2)$$

$$[\varepsilon_j u_j]' \sim N(0, \Omega).$$

In equation (1), α and β denote the elasticities of output with respect to physical capital and labour, respectively, and the coefficient of $\ln l_j$ measures the deviation from constant returns to scale. A is modeled as a function of our main variable of interest, the effect of the 'treatment' of being a certification holding firm (t_j), and of firm characteristics and technological activities (z_j), which directly affect firm productivity. This allows us to test hypothesis H3. In equation (2), w_j are the covariates used to model treatment assignment or certification. The error terms, ε_j and u_j, follow a bivariate normal distribution with mean zero and covariance matrix Ω. The covariates z_j and w_j are considered as exogenous explanatory variables, i.e. uncorrelated to the error terms. The model corresponds to an endogenous dummy regression model and is estimated by maximum likelihood.[1]

[1] We use the etregress command in Stata 13.0.

Variables

Standards certification, the dependent variable of the treatment equation, is measured by a binary variable equalling one if the firm responded positively to the question '*does this establishment have an internationally-recognized quality certification'*. The survey also provided a few examples, such as ISO9000, ISO9002 or ISO14000. Unfortunately, we cannot disentangle the various management standards, as the survey did not record the answer separately for different standards. However, there appears to be considerable overlap in the drivers behind the various certificates and in the benefits for the firm (Pan, Poksinska, Dahlgaard & Eklund, 2003; Pan, 2003) and in their international diffusion patterns (Corbett and Kirsch, 2001). The overlap between the various ISO standards has been further increased with the 2015 revision. In this revision a common framework for all the ISO management systems standards has been developed, with a high level of consistency and a common structure between all of the ISO management system standards. This is done to make it easier for businesses to adhere to multiple management standards, such as those for quality, the environment, health and safety, or business continuity. The integrated framework raises the expectation that the various standards will have a large common effect on managerial practice and firm performance and sustains their aggregation into one single measure, as we do in this study.

To test hypothesis H1, that adoption is more likely for more endowed firms closer to the frontier, the covariates w_j to explain certification are variables capturing firm characteristics such as firm size and age, and the financial resource endowment and capabilities. For access to financial resources, the variable *Credit* is included, which equals one if the firm has access to flexible credit. As a measure of human capital, we use different variables for manufacturing and services. For manufacturing, a variable *Skill* is used, which measures the proportion of skilled production employees in total production workers. For services this information is not available. Hence, we measure human resource endowment by the general manager's years of experience in the sector of activity, *Experience_GM*. To account for costs faced by firms due to the documenting and auditing procedures involved in seeking to obtain a certificate, we include the variable *Audit*, taking the value one if the firm's annual financial statements are checked and certified by an external auditor. A firm that is undergoing financial audits is likely to be better documented and codified, reducing the threshold to seek international certification on management practices. We include a variable *Frontierproximity_lagged*, which measures the relative productivity position of a firm in its industry and country, 3 years back. The definition and measurement of the variables used in the estimations and their summary statistics are presented in table 3.

To test hypothesis H2, that firms engaged in international transactions are more likely to have a certificate, w_j includes a binary variable *Export_lagged* for firms that were exporting 3 years prior to the year of observation; a binary variable *License* for firms licensing technology from a foreign company and a binary variable *Foreign* when the firm is at least partly foreign owned. *Industry and country* variables are also included to control for industry and country specific influences affecting the costs and expected benefits related to accreditation.

For identification purposes, it is essential that the treatment equation contains at least one explanatory variable that is not in the outcome equation. For this purpose, we included the variable *Certification_I*C*, which is the incidence of certification in a firm's industry, multiplied by the incidence of certification in a firm's country. It captures the demonstration effect that if certification is more common in a firm's industry and country, the firm is more likely to be aware of it and engage in certification itself.

For the productivity equation, the z_j set of variables includes *firm age* and *foreign* ownership, the human capital indicator *Skill*, and a variable *ICT* for firms that use ICT to interact with

Table 3. Definition of variables.

Dependent variables		Manufacturing		Services	
		mean	STD	mean	STD
IMC	=1 if firm has international management certification, such as ISO 9000 or ISO 14000	0.19		0.15	
Productivity	Sales per employee, in log.	14.06	2.30	14.63	2.58
Explanatory variables					
Export_lagged	Lagged export status; =1 if the firm started exporting more than three years prior to the last survey year	0.16	-	0.05	-
Employment_lagged	Firm size, measured by employment, three years back, in log.	2.90	1.34	2.43	1.15
Capital intensity	Capital stock in net book value/ employment, in log.	12.56	2.64	n.a.	-
Productivity_lagged	Lagged productivity, measured by sales per employee, three years back, in log.	13.79	2.47	14.39	2.70
Frontierproximity_ lagged	Lagged relative productivity position, measured by sales per employee, normalised, using the country-industry specific range, three years back	0.07	0.16	0.04	0.12
Firm Age	Age of the firm in the last year prior to the survey, in log.	2.49	0.85	2.28	0.91
Foreign	=1 if the firm is foreign owned	0.14	-	0.15	-
Skill	Proportion of skilled production workers in total production workers (manufacturing only)	0.51	0.34		
Experience_GM	Years of experience of the general manager			13.27	9.04
License	=1 if the firm uses technology licensed from a foreign-owned company	0.15	-	n.a.	-
Credit	=1 if the firm has access to flexible forms of credit through overdraft facilities with a bank	0.30	-	0.31	-
ICT	=1 if the firm uses a website to interact with clients and suppliers	0.25	-	0.24	-
Audit	=1 if the firm has its annual financial statements checked and certified by an external auditor	0.46	-	0.47	-
Certification_I*C	Certification likelihood, measured by product of the average certification in the firm's industry and the average certification in the firm's country	0.03	0.02	0.03	0.02

Unless otherwise indicated, the variables are measured in the last year prior to the survey, which might differ among countries. Lagged variables refer to three years back, since the last fiscal year prior to the survey. N.a.: not available;

clients and suppliers. The outcome variable *productivity* is measured by sales, instead of value added, since we have no data on value added for services and the only lagged measure of output we have is past sales. For services, there are no data available for the capital stock k_j. Clearly the capital stock is of more importance in manufacturing than in services. For both equations, the choice of variables was made so as to limit the differences between the sectors and to maximise comparability.

The endogeneity of the traditional inputs labor and capital could not be handled properly by way of GMM estimation or using proxies to factor out the unobserved component of ε_j that would be known to the producer and correlated with the input choices (following Olley-Pakes 1996), because we lack lagged variables or other potential instruments. To the extent that we have constant returns to scale and that the capital intensity can be seen as a state variable decided earlier than in the period where output is observed, the endogeneity problem is not so severe.

5. Results and Discussion

The results are presented in table 4. The variable *Certification_I*C*, exclusive to the selection equation, is significant in the selection equation and was not significant in the outcome equation. This variable can therefore be considered as a strong instrument in the selection equation. Country dummies are included in all equations. Industry dummies are included in the outcome equation, but not in the treatment equation. We formally tested the joint significance of the industry dummies in the treatment equation and found them to be insignificant[2]. The correlations between the two error terms are highly significant justifying the choice to estimate the two equations jointly.

For manufacturing, in line with other studies, we find that the likelihood of being a certified firm increases with firm size and firm age. Larger and older firms are the ones who have built up over time the capabilities and firm specific knowledge and practices to gain accreditation more easily and at lower cost. This is also supported by the variable which measures the relative position of the firm vis-à-vis the technology frontier in its industry and country three years ago. The variable *Frontierproximity_lagged* is indeed positive and significant, indicating that more efficient firms operating closer to the frontier are more likely to have an international management certificate. Focusing on managerial practices, firms with accounting records that are checked and audited by a third party, reducing the threshold to engage in the application procedures, are also more likely to have a certificate.

Certification is also more observed among firms with a history in exports than firms serving the local market only, and more among foreign firms than their domestic counterparts. We observe equally that firms with technology licensed from a foreign company have higher incidence of management certification. Hence the international transactions and international linkages through ownership and technology sourcing are clearly important determinants in the decision to adopt internationally certified management practices. In contrast, higher proportions of skilled production workers and access to flexible forms of credit do not show up as strong determinants of certificate adoption.

For services, the results are actually very similar though the magnitude of the coefficients

[2] A chi-square test on the joint significance of the 21 industry dummy variables produced a Chi-square statistic of 20.14 with a p-value of 0.5124 in manufacturing. For services, the Chi-square statistic was 5.31 with a p-value of 0.50. This result is due to the inclusion of the variable *Certification_I*C*, which mainly captures the industry influences on the likelihood of having a certificate. Without controlling for this variable, the indus try dummies are jointly significant at least in manufacturing.

and their significance may slightly differ. Size, age, and position relative to the frontier determine the incidence of accreditation. The *Credit* variable is positive and significant for services firms, the human capital variable, *Experience_GM*, remains insignificant but positive. The variables assessing the effect of international transactions and exposure, *Foreign* and *Export_lagged*, show up as positive and significant determinants of adoption.

Taken together these findings provide support for hypothesis H1 that certification is actually granted to high quality performers operating closer to the frontier. This is the result of efforts and capabilities development over time, as reflected by the size (*Employment_lagged*) and age of the firms, and familiarity with codification of business procedures, as reflected by *Audit*, which facilitates accreditation on the cost side. But also hypothesis H2 is supported, as all variables pointing to more complex international transactions and international technology sourcing show up as motivating factors favourably influencing the decision to gain certification.

Table 4. Maximum likelihood parameter estimates from the endogenous dummy variable model for manufacturing and services.

	Manufacturing		Services	
VARIABLES	IMC	Productivity	IMC	Productivity
IMC		0.566***		0.439***
		(0.116)		(0.129)
Employment_lagged	0.282***		0.188***	
	(0.028)		(0.023)	
Export_lagged	0.433***		0.414***	
	(0.079)		(0.091)	
Frontierproximity_lagged	0.294		0.552***	
	(0.182)		(0.175)	
Firmage	0.112***	0.031	0.060**	0.045**
	(0.038)	(0.022)	(0.029)	(0.020)
Foreign	0.218***	0.126**	0.410***	0.126**
	(0.084)	(0.054)	(0.063)	(0.051)
Skill	0.020	0.056		
	(0.080)	(0.050)		
Experience_GM			−0.001	-0.000
			(0.003)	(0.002)
License	0.956***			
	(0.076)			
Credit	−0.010	0.125***	0.202***	0.107***
	(0.073)	(0.043)	(0.056)	(0.040)
Certification_I*C	9.851***		11.302**	
	(1.764)		(5.453)	
Audit	0.440***		0.482***	
	(0.079)		(0.057)	
Capital intensity		0.054***		
		(0.009)		

Table 4. (*continued*).

	Manufacturing		Services	
VARIABLES	IMC	Productivity	IMC	Productivity
ICT		0.067		0.231***
		(0.046)		(0.041)
Productivity_lagged		0.581***		0.664***
		(0.012)		(0.009)
Constant	−3.199***	4.091***	−2.808***	4.615***
	(0.261)	(0.673)	(0.322)	(1.133)
Observations	3,466	3,466	5,148	5,148
Country dummies	yes	yes	yes	Yes
Industry dummies	no	yes	no	Yes
Log likelihood		−5771.53		−9599.70
Rho		−0.256***		−0.162***
		(0.074)		0.062
Sigma		0.942***		1.110***
		(0.012)		0.012
Lambda		−0.241***		−0.180***
		(0.071)		0.070

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Lambda is the product of rho and sigma.

Turning to the outcome equation, a large part of the variation in productivity is explained by the lagged labour productivity, pointing to persistence in productivity performance, both in manufacturing and services. This is a recurrent finding in empirical studies and could be attributed to unmeasured effects like intangibles (see Syverson, 2011). In manufacturing, productivity is further raised by higher levels of capital intensity. In both sectors, foreign ownership and access to flexible forms of credit significantly raise productivity outcomes in firms. The human capital variables do not prove significant in equation (1). The use of ICT is only significant in raising productivity in the services sector.

Our main interest, however, goes to the effect of *IMC* in the outcome equation. Interestingly the effect of certification indeed significantly raises the productivity level of firms in manufacturing and in services alike. In manufacturing, having a certificate raises labour productivity by about 77%[3]. The effect is significant at the 1% level. In services, certification raises productivity by 55%, significant also at the 1% level. These findings confirm the third hypothesis, that firms which implement management standards that are internationally accepted and gain certification for it actually benefit from continuous improvements and reach higher levels of productivity.

We also did some robustness analyses to validate our findings. First, we relaxed the assumption of constant returns to scale and added the employment variable, *Employment*, to the estimation. The results of this estimation are presented in table 5. It can be seen that for the manufacturing firms, the coefficient of employment is not significantly different from zero, suggesting constant returns to scale. For services, adding the variable *Employment* generates

[3] Calculated as (exp (0.566) -1)

Table 5: Parameter estimates from the endogenous dummy variable model, relaxing the constant returns to scale restriction.

	Manufacturing		Services	
VARIABLES	IMC	Productivity	IMC	Productivity
IMC		0.657***		0.665***
		(0.132)		(0.137)
Employment_lagged	0.285***		0.203***	
	(0.028)		(0.023)	
Export_lagged	0.430***		0.407***	
	(0.079)		(0.090)	
Frontierproximity_lagged	0.284		0.561***	
	(0.181)		(0.173)	
Firmage	0.114***	0.032	0.055*	0.051**
	(0.038)	(0.022)	(0.029)	(0.020)
Foreign	0.217***	0.126**	0.396***	0.124**
	(0.084)	(0.054)	(0.063)	(0.051)
Skill	0.022	0.048		
	(0.080)	(0.050)		
Experience_GM			−0.001	0.000
			(0.003)	(0.002)
License	0.940***			
	(0.077)			
Credit	−0.017	0.131***	0.190***	0.120***
	(0.073)	(0.044)	(0.056)	(0.040)
Certification_I*C	9.636***		11.108**	
	(1.767)		(5.404)	
Audit	0.441***		0.483***	
	(0.078)		(0.056)	
Employment		−0.023		−0.075***
		(0.021)		(0.020)
Capital intensity		0.054***		
		(0.009)		
ICT		0.074		0.265***
		(0.047)		(0.042)
Productivity_lagged		0.581***		0.664***
		(0.012)		(0.009)
Constant	−3.203***	4.149***	−2.843***	4.856***
	(0.261)	(0.671)	(0.322)	(1.131)
Observations	3,466	3,466	5,148	5,148

Table 5. (*continued*).

	Manufacturing		Services	
VARIABLES	IMC	Productivity	IMC	Productivity
Country dummies	yes	yes	Yes	Yes
Industry dummies	no	yes	No	Yes
Log likelihood		−5770.95		−9592.37
Rho		−0.309***		−0.268***
		(0.080)		(0.064)
Sigma		0.947***		1.118***
		(0.013)		(0.013)
Lambda		−0.293***		−0.299***
		(0.078)		0.074

Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Lambda is the product of rho and sigma.

a significant improvement in the model[4] and a significant coefficient indicating the presence of decreasing returns to scale. The other coefficients remain stable in sign and significance, but the coefficient of *IMC* is a bit more inflated. It moves up to 0.66 without much difference between industry and services.

We also estimated variations of the model that include in the outcome equation some of the variables from the selection equation that could in theory also be linked to productivity. Acknowledging the possible existence of learning-by-exporting, we added *Export_lagged* to the productivity equation. In a similar way, we also added *Licence* to the productivity equation, as firms may raise productivity from sourcing newer and more advanced technologies from abroad. Adding these variables to the outcome equation did not produce any significant coefficients for these variables and did not generate changes to our main findings[5].

Finally, given the important role we found for IMC in explaining productivity, we further tested an alternative framework, which distinguishes between two regimes - not having an IMC certificate (regime 1) and having an IMC certificate (regime 2) – and estimates the outcome (productivity) equation for each regime separately, allowing the other covariates to impact differently firms' productivity, depending on the IMC regime. We thus estimated an endogenous switching regression model, also known as the Roy model (see Wooldridge, 2010). Instead of showing the estimation results, we report in table 6 the average partial effects of all the regressors in the model on labour productivity for IMC-holders and IMC-non-holders, for manufacturing and services respectively. The average partial effects are thus conditional on the potential regime the firm operates in (see Dolton and Makepeace (1987) for the calculation of these marginal effects and their interpretation). What this model shows in addition to what we knew already is that the effects of certain variables differ in magnitude but also in significance depending on the IMC regime.

In manufacturing, productivity increases with the age of the firm for IMC-holders but no particular effect is found for non-IMC holders and again the opposite holds in services. Foreign ownership is associated with a higher labour productivity in manufacturing but only

[4] A likelihood-ratio test produces a chi-square statistic of 14.6, which is far above the critical value of 3.84 at the 5% level of significance.

[5] Likelihood-ratio tests indicated that the addition of *Export_lagged* and *License* did not produce any further improvement in the model, increasing the log-likelihood from -5770.95 to -5770.01 for manufacturing and from -9592.4 to -9592.2 for services, both differences being insignificant.

for non-IMC holders in services. Access to credit raises productivity for non-IMC holders but shows no significant effect for non-IMC holders (in both manufacturing and services). Let us now examine the indirect effects on productivity of variations in the regressors that appear only in the selection equation and that affect labour productivity via the standard deviations of the error terms and their mutual correlations. Because the correlation between the selection and the outcome equation is higher for the non-IMC holders in manufacturing, and the opposite is true in services, the effects of size, distance to the frontier, export status, audit and certification at the country/industry level are higher for IMC-holders in services and for non-IMC-holders in manufacturing. For example, if the proportion of IMC-holders in the industry and country (as measured and explained in table 3) increases by one percentage point, given that higher frequency in the environment increases the likelihood of adopting IMC and that IMC-holding firms tend to be more productive, labour productivity would increase by 1.64% if manufacturing firms were non-IMC holders and by 0.89% if they were IMC-holders. The emulation effect would be higher for non-IMC holders than for IMC holders in manufacturing (and the opposite in services). Another striking result is that there is more persistence in productivity in the services than in the manufacturing sector and also more persistence among the non-IMC holders than among those that hold an international management certificate. The use of ICT affects labour productivity in services but not in manufacturing, a result that was already noticed with the previous model. Given the striking difference in the productivity determinants between IMC and non-IMC holders, we favour the endogenous switching regression model.

Based on our estimates of the labour productivity under the two regimes, we can compute how the distribution of labour productivity differs between non-IMC holders and IMC-holders. In the manufacturing sector the expected labour productivity increases by 17 percent. In services, it increases by 15 percent. Those magnitudes are smaller than those of the endogenous dummy model reported in table 4. The differences in productivity between IMC and non-IMC holders are due to two factors. First, there are differences in the effects of the determinants, other than IMC, on labour productivity. Second, the correlation coefficients between the error terms in the productivity equations and the selection equation are negative, for both regimes and for both manufacturing and services. This implies that unobservables that increase the likelihood of being an IMC holder decrease the productivity of IMC holders and increase the productivity of non-IMC holders.

Table 6: Average partial effects of the regressors in the endogenous switching regression model.

	Manufacturing		Services	
Dy/dx VARIABLES	IMC = 0	IMC = 1	IMC = 0	IMC = 1
Firmage	0.013	0.127***	0.057***	-0.013
	(0.023)	(0.046)	(0.022)	(0.052)
Foreign	0.135**	0.212**	0.187***	0.008
	(0.061)	(0.091)	(0.059)	(0.126)
Skill	0.076	0.089		
	(0.050)	(0.148)		
Experience_GM			-0.001	-0.002
			(0.002)	(0.005)

Table 6. (*continued*).

	Manufacturing		Services	
Dy/dx VARIABLES	IMC = 0	IMC = 1	IMC = 0	IMC = 1
License	0.033	0.111		
	(0.069)	(0.097)		
Credit	0.101**	0.102	0.133***	-0.030
	(0.047)	(0.088)	(0.044)	(0.105)
Capital intensity	0.062***	0.041**		
	(0.010)	(0.018)		
ICT	0.002	0.123	0.217***	0.161*
	(0.052)	(0.084)	(0.046)	(0.097)
Productivity_lagged	0.601***	0.492***	0.673***	0.591***
	(0.014)	(0.025)	(0.010)	(0.024)
Employment_lagged	0.047***	0.026***	0.024***	0.089***
	(0.005)	(0.003)	(0.003)	(0.011)
Export_lagged	0.075***	0.041***	0.050***	0.188***
	(0.014)	(0.008)	(0.012)	(0.043)
Frontierproximity_lagged	0.007	0.004	0.077***	0.289***
	(0.035)	(0.019)	(0.022)	(0.083)
Certification_I*C	1.640***	0.891***	1.420**	5.300***
	(0.319)	(0.176)	(0.686)	(2.560)
Audit	0.085***	0.046***	0.061***	0.227**
	(0.014)	(0.008)	(0.007)	(0.027)
Observations		3,466		5,148
Rho	−0.601***	−0.145	−.376***	−.467***
	(0.062)	(0.107)	(0.087)	(0.144)
Sigma	0.962***	0.901	1.102***	1.276***
	(0.016)	(0.027)	(0.016)	(0.077)

Notes: Dy/dx, marginal effect of covariates on the expected productivity, in different regimes depending on the status of certification (IMC = 0 or IMC = 1); Standard errors in parentheses;
Significance levels: *** p < 0.01, ** p < 0.05, * p β 0.1
Rho: correlation of the error term with the error term of the selection equation.
Sigma: standard deviation of the error term.

Discussion

The findings in this paper provide robust micro evidence supporting a widely held, yet empirically poorly documented, view that "in developing the capacity to achieve standards, many producers develop capabilities which enhance their efficiency and their capacity to systematically increase productivity" (Kaplinsky, 2010, p.1). That implementing standards trigger innovation and act as a learning mechanism leading to further improvement in

performance is advanced in various industry studies (Pietrobelli and Rabelotti, 2011), but only very few firm-level analyses exist (exceptions are Goedhuys and Sleuwaegen 2013; Fikru, 2014a).

A central difficulty is the detection of the direction of causality. Does the certification of management standards improve productivity or are the more productive firms more inclined to get those certifications? Fikru (2014a) and Henson et al. (2011) use propensity score matching techniques to test the effect of certification on exports. This paper addresses the endogeneity of certification by way of modeling the selection and allowing for correlations between the unobservables in the selection and the productivity equations. First, we estimate an endogenous dummy variable model by specifying a selection equation and by making the productivity conditional on the selection outcome. In a second model, the endogenous switching regression model, we allow for a different productivity equation depending on the selection outcome. And, indeed, we find differences in the productivity schedule between certificate holders and non-holders.

We find that the more efficient firms are the ones that obtain a certificate in the first place, but also that certification further increases performance. We use a broad performance indicator – productivity - which is important in the context of developing countries, where structural transformation of the economies is expected to come from a shift from low to higher value added production techniques.

In this context, our findings should also be confronted with the view of some authors who question the effect of certification due to lower quality of the audits in developing countries (Christmann and Taylor, 2006). They advance that the certification procedure is done by private firms who provide assistance in the application procedure, but who also play a regulatory role in penalising their own clients in case of non-compliance. This conflict of interest reduces the quality of the audits and leads to misuse of the system, decoupling certification from the actual implementation of best practice. The effectiveness of standards to trigger innovation and productivity would in this context vanish. Our findings do not support the view that certification and implementation of best practice standards would be unrelated, so called 'symbolic' certification. Of course, there may be cases of abuse that we cannot trace with the data, but the general tendency is that better firms acquire certification and improve performance subsequently. As Graham and Woods (2006) state government interventions and interventions by international organizations remain nevertheless vital to guarantee high audit quality which is necessary for an effective and sustained self-regulatory mechanism.

Finally it is important to stress that our study provides evidence on management practices in relation to firm productivity for African firms. Studies on this topic often relate productivity differences to technological and innovation variables, and institutional failures -such as regulatory burdens, red tape and corruption- and market failures such as in the provision of finance, infrastructure, and skilled labour. Only more recently have management practices received more attention, following interesting studies by Bloom and Van Reenen (2007, 2010) and Bloom et al. (2010, 2011), who develop an instrument for measuring management practice. They point at the huge differences in management practices in developing country firms, relating them to productivity differences. Our variable being a measure for management capability, it provides evidence in line with Bloom and co-authors stressing the importance of solid management practices to raise productivity in African firms.

6. Conclusion

Using evidence from manufacturing firms of 41 African countries, this paper corroborates the view that international management certification raises firm productivity. More efficient firms

and firms endowed with human and financial capital resources are more likely to possess an international management certificate with worldwide recognition. This in turn forces the firm to permanently stay alert on management quality issues, raising productivity levels further.

The certification process is essentially a learning process taking place in the firm, leading to organisational change and productivity improvements. From a policy perspective, it should be considered that stimulating adherence to world standards may be important component in industrial policy. A policy instrument lies in the creation of awareness of the importance of standards, and the provision of information and infrastructure to facilitate adherence to it. Policy makers could consider various actions to encourage the dissemination and implementation of international management standards[6], e.g. through training and provision of assistance to younger and smaller firms; to improve standardization infrastructure, to develop capacities and business services to guide firms through the certification process, and to establish standards bureaus, which would provide the industry and government with the necessary information on international standards, thereby facilitating market access.

Finally, it should be underscored that the study is conducted on a large pooled set of existing data, and as such limited by the data. Panel data and information on the moment the certificate has been awarded would allow a more rigorous approach testing the evolution of performance before and after the treatment. This has not been possible with our cross section. Another interesting extension would be to have better insights in the types of certification. For instance, the ILO identified productivity and working conditions in SMEs as an area of critical importance for the Organisation. It would be interesting to test the effect of various types of standards, such as management standards related to product quality, environmental conduct, or labour conditions, for the performance of small firms in Africa.

Acknowledgements

The authors would like to thank the anonymous referee for the constructive comments on the first version of the paper.

References

Albornoz, F., Milesi, D., & Yoguel, G. (2002). New Economy in old sectors: some issues coming from two production networks in Argentina. Paper presented at the DRUID summer conference, Copenhagen/Elsinore 6-8 June 2002.

Bellesi, F., Lehrer, D., & Tal, A. (2005). Comparative Advantage: The Impact of ISO 14001 Environmental Certification on Exports. Environmental Science & Technology, 39(7), 1943-1953.

Blind, K., & Hipp, C. (2003). The role of quality standards in innovative service companies: An empirical analysis for Germany. Technological Forecasting and Social Change, 70(7), 653-669.

Bloom, N., & Van Reenen, J. (2007). Measuring and explaining management practices across firms and countries. Quarterly Journal of Economics, 122(4), 1351-1408.

Bloom, N., & Van Reenen, J. (2010). Why do management practices differ across firms and countries? The Journal of Economic Perspectives, 24 (1), 203-224.

Bloom, N., Eifert, B., Mahajan, A., McKenzie, D., & Roberts, J. (2013). Does management matter? Evidence from India. The Quarterly Journal of Economics, 128(1), 1-51.

Bloom, N., Mahajan, A., McKenzie, D., & Roberts, J. (2010). Why do firms in developing countries have low productivity? American Economic Review, 100(2), 619-623.

[6] And by extension, the equally important international product standards for which adherence is equally a condition for export.

Casadesus, M., & Gimenez, G. (2000). The benefits of the implementation of the ISO 9000 standard: Empirical research in 288 Spanish companies. TQM Magazine, 12(6), 432-441.

Christmann, P., & Taylor, G. (2006). Firm self-regulation through international certifiable standards: determinants of symbolic versus substantive implementation. Journal of International Business Studies, 37(6), 863-878.

Clougherty, J. A., & Grajek, M. (2008). The impact of ISO 9000 diffusion on trade and FDI: A new institutional analysis. Journal of International Business Studies, 39(4), 613-633.

Corbett, C. J., & Kirsch, D. A. (2001). International diffusion of ISO 14000 certification. Production and Operations Management, 10(3), 327-342.

Corbett, C. J., Montes-Sancho, M. J., & Kirsch, D. A. (2005). The financial impact of ISO 9000 certification in the United States: An empirical analysis. Management Science, 51(7), 1046-1059.

Czubala, W., Shepherd, B., & Wilson, J. S. (2009). Help or hindrance? The impact of harmonised standards on African exports. Journal of African Economies, 18(5), 711-744.

Dolton, P.J. and G.H. Makepeace (1987), Interpreting sample selection effects, Economic Letters, 24, 373-379.

Dunu, E. S., & Ayokanmbi, M. F. (2008). The Impact of ISO 9000 Certification on the Financial Performance of Organizations. Journal of Global Business Issues, 2(2), 135-144.

Fikru, M. G. (2014a). Firm Level Determinants of International Certification: Evidence from Ethiopia. World Development, 64, 286-297.

Fikru, M. G. (2014b). International certification in developing countries: The role of internal and external institutional pressure. Journal of Environmental Management, 144, 286-296.

Fransman, M. (1985). Conceptualizing technical change in the third world in the 1980s - an interpretive survey. Journal of Development Studies, 21(4), 572-652.

Gebreeyesus, M. (2014). Firms' adoption of international standards: Evidence from the Ethiopian floriculture sector. UNU-MERIT Working paper 2014/007, Maastricht, the Netherlands.

Goedhuys, M., & Sleuwaegen, L. (2013). The Impact of International Standards Certification on the Performance of Firms in Less Developed Countries. World Development, 47, 87-101.

Graham, D. and N. Woods (2006). "Making corporate self-regulation effective in developing countries." World Development 34(5): 868-883.

Heckman, J. J. (1979). Sample selection bias as a specification error. Econometrica, 47(1), 153-161.

Henson, S., Masakure, O., & Cranfield, J. (2011). Do Fresh Produce Exporters in Sub-Saharan Africa Benefit from GlobalGAP Certification? World Development, 39(3), 375-386.

Heras, I., Dick, G. P. M., & Casadesús, M. (2002). ISO 9000 registration's impact on sales and profitability. International Journal of Quality & Reliability Management, 19(6), 774-791.

Iizuka, M. (2009). Standards as a platform for innovation and learning in the global economy: a case study of the Chilean salmon farming industry. International Journal of Technological Learning, Innovation and Development, 2(4), 274-293.

ISO (2016) Iso in Services, webpage http://www.iso.org/iso/home/news_index/iso-in-action/services.htm accessed 15.03.2016.

Jaffee, S. M., & Henson, S. (2005). Agro-food exports from developing countries: the challenges posed by standards. In: Aksoy, M. and Beghin, J. (eds) Global Agricultural Trade and Developing Countries, Washington: World Bank.

Kaplinsky, R. (2010). The role of standards in global value chains and their impact on economic and social upgrading. World Bank Policy Research Working Paper No. 5396, the World Bank, Washington D.C..

King, A. A., Lenox, M. J., & Terlaak, A. (2005). The strategic use of decentralized institutions: Exploring certification with the ISO 14001 management standard. Academy of Management Journal, 48(6), 1091-1106.

Lall, S. (1992). Technological capabilities and industrialisations. World Development, 20(2), 165-186.

Maertens, M., & Swinnen, J. F. M. (2009). Trade, Standards, and Poverty: Evidence from Senegal. World Development, 37(1), 161-178.

Martinez, M., & Poole, N. (2004). The development of private fresh produce safety standards: implications for developing Mediterranean exporting countries. Food Policy, 29(3), 229-255.

Nadvi, K., & Waltring, F. (2004). Making sense of global standards. Local Enterprises in the Global Economy: Issues of Governance and Upgrading, In H. Schmitz (Ed.), Local enterprises in the global economy: Issues of governance and upgrading (pp. 265). Cheltenham: Edward Elgar Publishing.

Olley, S. and A. Pakes (1996). The dynamics of productivity in the telecommunications industry. Econometrica, 67(3), 1263-1297.

Pan, J. N. (2003). A comparative study on motivation for and experience with ISO 9000 and ISO 14000 certification among Far Eastern countries. Industrial Management and Data Systems, 103(8-9), 564-578.

Peteraf, M. A. (1993). The cornerstones of competitive advantage: A resource-based view. Strategic Management Journal, 14(3), 179-191.

Pietrobelli, C., & Rabellotti, R. (2011). Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries? World Development, 39(7), 1261-1269.

Poksinska, B., Dahlgaard, J. J., & Eklund, J. A. E. (2003). Implementing ISO 14000 in Sweden: Motives, benefits and comparisons with ISO 9000. International Journal of Quality and Reliability Management, 20(5), 585-606.

Quadros, R. (2004). Global quality standards and technological upgrading in the Brazilian auto-components industry. In H. Schmitz (Ed.), Local enterprises in the global economy: Issues of governance and upgrading (pp. 265). Cheltenham: Edward Elgar Publishing.

Sampaio, P., Saraiva, P., & Rodrigues, A. G. (2009). ISO 9001 certification research: Questions, answers and approaches. International Journal of Quality and Reliability Management, 26(1), 38-58.

Swann, P., Temple, P., & Shurmer, M. (1996). Standards and Trade Performance: the UK Experience. The Economic Journal, 106(438), 1297-1313.

Syverson, Chad (2011). What determines productivity? Journal of Economic Literature 49(2): 326–365.

Terlaak, A., & King, A. A. (2006). The effect of certification with the ISO 9000 Quality Management Standard: A signaling approach. Journal of Economic Behavior & Organization, 60(4), 579-602.

Turner, C. R., Ortmann, G. F., & Lyne, M. C. (2000). Adoption of ISO 9000 quality assurance standards by South African agribusiness firms. Agribusiness, 16(3), 295-307.

Unnevehr, L. J. (2000). Food safety issues and fresh food product exports from LDCs. Agricultural Economics, 23(3), 231-240.

Viadiu, F. M., Fa, M. C., & Saizarbitoria, I. H. (2006). ISO 9000 and ISO 14000 standards: an international diffusion model. International Journal of Operations & Production Management, 26(2), 141-165.

Wagner, J. (2006). "Export Intensity and Plant Characteristics: What Can We Learn from Quantile Regression?" Review of World Economics 142(1): 195-203.

Wooldridge, J. M. (2010). Econometric Analysis of Cross section and Panel Data: MIT press.