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Drivers of productivity in Vietnamese SMEs

The role of management standards and innovation

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Abstract: Using a rich panel dataset of SMEs active in the manufacturing sector in Viet Nam, this paper investigates the drivers of firm productivity, focusing on the role played by international management standards certification. We develop and test the hypothesis that, controlling for technological innovation (product and process) and other variables related to technological capabilities, international standards are still conducive to higher productivity, through improved management practices associated with their adoption. In line with the requirement of continuous improvement implied by most international standards, the main findings show that the possession of an internationally recognized standard certificate leads to significant productivity premium. We further investigate the relationship between technological innovation and standard adoption. We find that the likelihood of certificate adoption is higher when firms implement technological innovations and that the effect of certification on productivity is particularly strong for firms with technological innovation.

Keywords: management standards, ISO certification, technological innovation, productivity, Viet Nam
JEL classification: D22, D24, L20, O12, O30

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1 Introduction

The economic performance of Viet Nam in the last decade has been impressive (McCaig and Pavcnik 2013). Between 2000 and 2011, gross domestic product (GDP) has grown at 7 per cent per year, despite a slowdown due to the 2008 crisis. This economic growth has come along with a shift of labour from lower productivity sectors, typically agriculture, to more modern and productive sectors, such as services and manufacturing, leading to a rise in aggregate productivity (Abbot et al. 2015). Foreign companies and foreign direct investment (FDI) are acknowledged to have played a leading role in fostering this process: they contributed to a large share of production and export of relatively higher value-added productions in manufacturing sectors (Nguyen 2014)

By contrast, the performance of domestic small and medium-sized firms shows a more mixed picture. In the manufacturing sector, labour productivity of domestic SMEs has been stagnating since 2011. Nevertheless, large differences among sectors and across different types of firms are observed (CIEM 2016). To develop policies oriented towards broad-based, inclusive, and sustained growth, it is therefore necessary to study the performance of national Vietnamese firms and its determinants. An accurate micro-data analysis of firm productivity is crucial to establish the basis upon which growth may continue.

This paper builds on a rich literature on the drivers of productivity at the micro level. With the diffusion of micro-data, and acknowledged by endogenous growth models (Romer 1986; Lucas 1988; Scott 1989), technological capabilities and learning-related variables, such as technology and innovation activities and outputs, became variables of primary interest in accounting for firm productivity. However, the observed relationship between technological innovation and firm productivity in developing countries has not always been in line with findings from advanced economies, presenting a lower than expected effect of technological innovation on firm-level productivity (Benavente 2006; Goedhuys et al. 2008). More recently, other factors related to the improvement of organizational and managerial practices have been gaining attention. Bloom and Van Reenen (2007, 2010) developed a measure for managerial practice and showed that a majority of firms in developing and emerging countries suffer from poor management, with associated low levels of productivity. A major way for firms in developing and emerging economies to develop managerial and organizational practices that are up to world standards is through the adherence to and implementation of international management standards, such as the widely known and adopted ISO 9001 and ISO 14001. These standards provide a model for setting up a management system that should enable adopting firms to reach particular targets, being either quality or environmental sustainability. The adoption of this type of standards is done on a voluntary basis, and adherence to their requirements is assessed by third parties, which conduct periodical audits even once the certificate has been obtained.

In Viet Nam, the adoption of management standards and certification is following the trend that has been witnessed on a global scale. With the opening of the Vietnamese economy in 1986 and membership of ASEAN in 1997 and WTO in 2007, domestic manufacturing firms became increasingly exposed to new regulation and foreign buyer requirements about internal firm organization and process management characteristics. Certification of standards became an accepted way of addressing customer expectations about product and production process characteristics, such as quality, safety, environmental impact, or social accountability between suppliers and buyers and led to increased re-organization of companies to address these expectations. Among the internationally recognized standards, the most frequently applied are ISO 9001 and ISO 14001 (ISO 2016a). The number of ISO 9001 certificates has been increasing since 1995, when the first certificate was issued, to reach 7,000 newly issued certificates in 2009. The first ISO 14001 certificate was issued in 1999. The number of these certificates only surpassed 1,000 in 2015.

Despite this trend, the empirical investigation on the role of adopting standards on firm productivity remains scarce. The availability of information about the Viet Nam manufacturing sector has spurred studies on firms' characteristics and productivity, but mainly from a specific perspective such as formality or clusters (Howard et al. 2014; Rand and Torm 2012). International standards have been investigated only in relation to work conditions (Trifković 2015) or living conditions of households (Hansen and Trifković 2014).[1] Hence, an investigation of the role played by international standards on firm-level productivity is still lacking. This paper aims at filling this gap, contributing to enrich the empirical literature on SMEs productivity in the context of developing and emerging countries by investigating the drivers of productivity among SMEs in Viet Nam's manufacturing sector.

Using three rounds of panel data, this paper investigates the role of international management standard certifications, as indicator of management quality, in affecting the productivity performance among Vietnamese SMEs. Controlling for the effect of technological innovation (product and process) and other technological capabilities-related variables (e.g. training), we provide empirical evidence that firms with an international standard certification can indeed achieve higher productivity levels. We argue that this 'net' effect of standards reflects the improvement in organizational and managerial practices associated with international standard adoption and implementation. We also provide new insights into the relationship between standard and technological innovation, contributing to the debate about whether these decisions could be considered as intertwined or, rather, separate strategies. First, we find that the likelihood of certificate adoption is higher when firms implement technological innovations. Then, exploring whether the coefficient of international standard in the productivity equation may be affected by having implemented an innovation, we find a stronger effect of the standard for innovators. This finding is robust to controlling for human capital and different definitions of labour productivity. Overall, the implications of our results may be found useful for public policies aiming at increasing overall productivity levels among SMEs.

With the availability of a rich panel database, we can implement an identification strategy with the inclusion of an extensive set of control variables in the empirical specification including firm, sector, and time-fixed effects along with time-varying firm- and sector-level controls. We correct for any remaining sources of endogeneity with an instrumental variables approach.

The paper is structured as follows. Section 2 presents a review of the empirical literature on productivity determinants in developing countries and presents hypotheses for testing. Section 3 describes the data, the model, and the estimation strategy. Section 4 presents the results and discussion. Section 5 discusses the findings in a broader context. Section 6 concludes, highlighting the policy implications of our findings and the possible avenues for future research.

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[1] Trifković (2016) investigates the impact of international standards on labour productivity of SMEs from the food sector in Viet Nam, while we offer evidence for 18 manufacturing sectors.

2 Literature

2.1 Innovation, management practices, and productivity

Spurred by endogenous growth theories (Lucas 1988; Romer 1986), technological innovation outputs (such as product and process innovations) and innovation activities (such as research and development (R&D)) have been lying at the core of the empirical literature investigating the drivers of productivity at the micro level. Most of these empirical studies have followed a production function approach (Crepon et al. 1998). While these models have provided convincing evidence of a positive effect of technological innovation on firm productivity in the case of developed economies, the available evidence for a developing context presents mixed and more ambiguous results, as not all works find evidence of a clear positive impact (Benavente 2006; Chudnovsky et al. 2006; Goedhuys et al. 2008; Hegde and Shapira 2007).

These results have been partly explained by the different conditions in which innovation activities are undertaken in a developing context (OECD 2005).[2] Firms in developing countries present lower levels of human capital, and their technological capabilities are scarce and less diffused compared to advanced economies. Most of them are micro and small enterprises, not working on the technology frontier, and their process of learning is more related to activities such as imitation, adaptation, and mastery of technologies developed somewhere else. The innovation outcomes are not likely to be generated through R&D departments, and tend to be less radical and more incremental in nature. In response to the weaker role played by 'traditional' technology-related and technological innovation-related variables, a broader set of possible explanatory factors should then be included in productivity analyses for SMEs, such as: cooperation, knowledge diffusion related to human and social capital, human resource management, and non-technological innovations such as marketing and organizational ones, which may encompass both organizational learning and improvements in operational and management practices (Bloom et al. 2012b; Bloom and Van Reenen 2010; Camisón and Villa-López 2014; Gunday et al. 2011; Jiménez-Jiménez and Sanz-Valle 2011).

Past decades witnessed the expansion of managerial literature on the positive impact of quality management practices on firm performance levels in advanced economies (Bloom and Van Reenen 2007, 2010; Bloom et al. 2012b; Kaynak 2003; Nair 2006), as well as in the context of developing and emerging countries (Bloom et al. 2012a; Bloom et al. 2012c). As shown by some of these studies, SMEs in developing and transition economies tend to operate far from the 'international frontier' of managerial systems and organizational practices, which may be persistent and further hindering firm performance. Bloom et al. (2013) argue that better managerial practices may significantly increase productivity and efficiency in some Indian textile firms, as well as foster the application of other potentially productivity-enhancing factors, such as computer usage. Moreover, managerial systems differ largely across countries, firms and sectors (Bloom et al. 2012a; Bloom et al. 2012b; Bloom et al. 2012c; Bloom and Van Reenen 2007, 2010), but in a developing country these differences are exacerbated by the existence of informational barriers that limit the spread of best practices (Bloom et al. 2013).

2.2 International management standards and management practices

A possible way to source knowledge on management practices is through the adherence to international standards. International standards represent a form of codified knowledge that can

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[2] See Annex A, 'Innovation surveys in developing countries', of the Oslo Manual (OECD 2005: 136).

bring management systems to a more sophisticated level than the practices generally diffused in a developing context. For this reason, management standards certifications have started to be used in firm-level productivity analyses as a proxy for the adoption of advanced quality management practices in developing countries (Sadikoglu and Zehir 2010).[3]

International management standards—such as the ISO 9001 or the ISO 14001 issued by the International Organization of Standardization (ISO 2016b)[4]—represent a systematization of 'how things should be done' within and between firms, in line with global management experience and internationally acknowledged good practices. These management standards are based on a series of principles—including, among others, customer focus, leadership, continuous improvement, human resources engagement, coordination, evidence-based decision making, monitoring, and evaluation.

In practice, international standards provide a model to follow when setting up and operating a management system in line with specific principles and targets, which can vary from product quality (ISO 9001), environmental performance (ISO 14001), and working conditions to food safety, occupational health, and safety, etc. Thus, the adoption of international standards may require reshaping of internal procedures, re-organizing and eventually routinizing some processes in order to make them more efficient. Furthermore, once a certification has been obtained, firms have to go through regular assessments and audits to be able to maintain it, which often requires that processes fostering monitoring, continuous learning, and improvement—the fundamental principles of management standards—are put in place.

Since the early 2000s, managerial and empirical studies have investigated both the determinants of adoption as well as the effects of management standards certification on firm performance. In particular, the possible impacts of standards have been classified as possibly being '*external*' or '*internal*' (Heras-Saizarbitoria and Boiral 2013; Sampaio et al. 2009). *External* benefits result from a reduction of transaction costs, as certificates would signal that the firm is a reliable partner, with a better-quality reputation, raising credentials in the marketplace (Djupdal. and Westhead 2015; Goedhuys and Sleuwaegen 2013, 2016; Potoski and Prakash 2009; Terlaak and King 2006). As a result, the external benefits of certification can be seen in sales increases, usually due to the expansion of trade and export activities (Henson and Jaffee 2006; Henson et al. 2011; Maertens and Swinnen 2009; Masakure et al. 2011; Potoski and Prakash 2009).

Internal benefits are instead related to certification-driven improvements in fundamental operations of the firm, leading to systematization of procedures, increased efficiency in the use of resources, and better performance. Within relevant managerial literature, many studies analyse the effect of ISO 14001 on environmental and non-environmental performance (Gonzalez et al. 2008; He et al. 2015; Heras-Saizarbitoria et al. 2011; Iraldo et al. 2009; Lannelongue et al. 2015; Nguyen and Hens 2015) and the impact of other quality management standards (like ISO 9001) on firm

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[3] Bloom and Van Reenen (2007) measure management practices by assigning a score to 18 key management categories, which are related to 'good management' factors, such as: structure and rationale of production processes, documentation, performance tracking and assessing, setting targets, and human capital management (6 out of 18 categories refer to human capital). These categories are directly comparable with the principles of international management standard, such as the family of ISO management system standards.

[4] See Marimon Viadiu et al. (2006) for an analysis of worldwide diffusion and adoption of the ISO 9001 and ISO 14001 standards. For more information about the features, requirements, and purposes of ISO 9001:2008 and the newly implemented ISO 9001:2015 see ISO (2016b),

financial, operational, and organizational performance (Aba et al. 2016; Gray et al. 2015; Kartha 2016; Koc 2007; Psomas et al. 2013).

2.3 Standards certification and productivity

Only a handful of studies empirically investigate how the implementation of an international standard certification can affect productivity (Goedhuys and Mohnen 2017; Goedhuys and Sleuwaegen 2013; Trifković 2016). The *internal* benefits associated with international quality management system standards ultimately reflect into higher productivity levels. The literature, however, recognizes that, in parallel with improving managerial and operational practices, the adherence to management standards may also promote positive changes in other domains, potentially leading to productivity increases: human resources management and technological innovation. Obtaining and maintaining a standard may require investments in training of employees to develop skills and capabilities, thus contributing to increasing the level of human capital (Blunch and Castro 2005). Evidence has also been found that firms adhering to standards are more likely to provide better work conditions for their labour force, experiencing positive effects on the employees (Levine and Toffel 2010; Trifković 2015). Thus, introducing better practices for human resources as part of overall management quality improvements, providing training to increase human capital, and improving workplace safety and satisfaction may contribute to better work conditions and better employee performance, ultimately reflecting into increased labour productivity (Delmas and Pekovic 2013; Lo et al. 2014; Sadikoglu and Zehir 2010).

Standards may also positively contribute to the innovation performance of firms (Manders 2016; Pekovic and Galia 2009; Ratnasingam et al. 2013; Sadikoglu and Zehir 2010), and consequently productivity. This may be the case when, in preparation to obtain a certificate, firms upgrade their existing capital stock and invest in new-vintage machinery and equipment (e.g. less polluting, more constant, etc.) which is in line with the definition of process innovation. Furthermore, even when a certificate has been already obtained, the continuous improvement requirements—common to most used international certifications like ISO 9001—may positively affect the innovation performance. Finally, the same adoption of superior quality managerial systems and operational practices may help firms build technological capabilities and strengthen their ability to develop and absorb knowledge and, thus, to implement technological innovations (Bernardo 2014; Camisón and Villa-López 2014; Hoang et al. 2006; Jiménez-Jiménez and Sanz-Valle 2011).

A detailed analysis of the causal relations between the decisions of adoption and implementation of international management standards on one side and technological innovation on the other side is beyond the scope of this work. Our objective is to empirically test the 'direct' effect of standard certifications on labour productivity. However, to make sure we disentangle the 'net' and 'direct' effect of standards due to improved management practices from its possible 'indirect' effect through technological innovation and training, we include these variables as controls in the productivity equation. In doing so, we provide empirical lower-bound evidence that international standard certifications contribute to explaining productivity differences among firms, through the enforcement of improved managerial and organizational practices.

3 Empirical approach

3.1 Data source

The data used in the present study come from the 2011, 2013, and 2015 rounds of the Small and Medium Scale Manufacturing Enterprise (SME) survey[5] conducted since 2005 every second year to assess the characteristics of the Vietnamese business environment. The survey was conducted in 10 provinces: Ho Chi Minh City (HCMC), Hanoi, Hai Phong, Long An, Ha Tay, Quang Nam, Phu Tho, Nghe An, Khanh Hoa, and Lam Dong.[6] The random sample was stratified by ownership type to include: household establishments, private enterprises, collectives or cooperatives, and limited liability and joint stock companies. It includes only firms active in manufacturing sectors and with less than 300 employees.[7] Apart from the enterprises interviewed in 2005 that still operate, the sample contains enterprises added to replace those that in the meantime have stopped operating or have changed owners, sector, or location.[8]

For this analysis, we use, on the one hand, an unbalanced sample of 3,065 micro, small, and medium enterprises that have participated in at least one of the survey waves between 2011 and 2015; on the other hand, the balanced sample, including firms that participated in all considered survey waves, is limited to 1,098 firms. Firms that operate in agriculture and with the participation of foreign or state capital are excluded from our analysis, to have a more homogenous sample of domestically owned SMEs.

The questionnaire includes information on enterprise characteristics and practices, such as number and structure of workforce, technology and innovation, international standard certification, revenues and costs, inputs, customers, owner characteristics, and economic constraints.

3.2 Empirical model and estimation strategy

Consistently with our main interest in the effect of standards on productivity, we base the estimation on a Cobb-Douglas production function which includes, alongside the conventional production factors of capital and labour, a number of innovation-related factors, including international standard certifications.

[5] The survey has been conducted in collaboration between the Central Institute for Economic Management (CIEM) of the Ministry of Planning and Investment of Vietnam (MPI), the Institute of Labor Science and Social Affairs (ILSSA) of the Ministry of Labor, Invalids and Social Affairs of Vietnam (MOLISA), the Development Economics Research Group (DERG) of the University of Copenhagen, and the United Nations University World Institute for Development Economics Research (UNU-WIDER). For more information about the surveys and data see CIEM et al. (2016).

[6] The first SME survey in all 10 provinces took place in 2005. The enterprise population size was 164,468 in the considered provinces in 2005, yielding the target sample of 2,864 enterprises. Out of the target sample, 2,649 firms were interviewed in 2015. The current sample is a direct continuation of the sample obtained in 2005.

[7] However, due to changes of sector over time, it may be possible that some firms still appear in the list of manufacturing firms even though they in fact moved to services. Firms that over time became larger than 300 employees have been excluded.

[8] The replacement enterprises were sampled randomly from the updated lists of active enterprises obtained from the local authorities in each survey location. The sampling strategy involved replacing enterprises within the same ownership structure and location.

We estimate the function of the following form:

$$y_{it} = \gamma_1 + \gamma_2 ln(K_i/L_i)_t + \gamma_3 lnL_{it} + \gamma_4 S_{it} + \gamma_5 INN_{it} + \gamma_6 X_{it} + \gamma_7 C_{it} + \varepsilon_{it} \quad (1)$$

where y_{it} denotes productivity of firm i in year t, measured as sales per employee, K_{it} denotes capital input, L_{it} represents labour; S_{it} is standards certification, and INN_{it} innovation. We also include a number of time-varying firm-specific characteristics (X_{it}), and location- and sector-specific control variables (C_{it}) to capture location and industry differences in productivity. The idiosyncratic error term (ε_{it}) is assumed to be normally distributed ($\varepsilon_{it} \sim N(0,1)$).

We focus on the relationship between standard certification and productivity, which is identified from the impact of standard on the within-firm variation in productivity over time, controlling for all time-invariant heterogeneity in firms. Identifying the causal impact of standards on productivity is challenging as the adoption is not randomly distributed across firms. We have to take into account that endogeneity may be present, and from multiple sources. First, the estimation could suffer from simultaneity bias when the most efficient and productive firms are more likely to have the resources to obtain certifications more easily. In this case, the causality may run the other way round, with productivity partly driving the certification decision.

Second, endogeneity issues may also arise when both the dependent and some independent variables are driven by the same unobservable factors, which may or may not change over time (e.g. management ability). Controlling for time and sector-specific effects addresses one part of this problem, but there could also be time-varying characteristics, such as a change in management or preferences for certification that could bias the estimation. To deal with such endogeneity concerns, we implement a two-stage least squares (2SLS) estimation in which we instrument the binary variable for international standard certification with a set of instrumental variables, which are correlated with having a standard but do not have an independent impact on labour productivity.[9] As instruments, we use a dummy variable equalling one if a firm has been required by customers to obtain any internationally recognized certification[10] and a variable resulting from the interaction of the province-sector share of standards with the magnitude of firm's social network.[11] These variables capture the exposure of firms to information about standards, allowing a 'network effect' in adopting a standard as firms look at their local competitors and are influenced by their decisions to apply for a standard certificate. The rationale for the choice of these instruments follows the relevant empirical literature (Goedhuys and Mohnen 2017; Hansen and Trifković 2014; Trifković 2015).

The inclusion of the innovation variable in the model is likely to raise similar endogeneity concerns as with the variable for certification of international standard. As finding a suitable instrument for innovation alongside standard is extremely challenging, we address this concern by splitting the sample by innovation and instrumenting the variable for standard. In this way, we can separately measure the effect of standards for firms with and without technological innovation.

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[9] The results of the validity test for these instruments are reported in the next section, at the bottom of Table 5.

[10] This variable is obtained from a question whose answer is not conditional on having declared to have a standard certification. Despite being highly correlated with the variable for having an international standard, it does not affect labour productivity (see Trifković (2015) for more information on the use of this variable).

[11] The variable is obtained by interacting province-sector (4-digit) share of standards with social network size and the rate of internet use by firms at the district-sector (2-digit) level. The province-sector share of standards is the share of standards in each province-sector (4-digit) in the two-year average number of all ISO certificates issued in Viet Nam.

3.3 Variables

In our equation, the dependent variable (y_{it}) is measured as the (log of) sales per employee in a firm i in time t. The independent variables include capital ($ln(K_i/L_i)_t$) and labour (lnL_{it}). We also control for quality of human capital (proxied by training and share of professional workers) and quality of physical capital (proxied by the share of machinery which is under three years old). Table 1 presents the definitions for the used variables.

We introduce international standard certification as our main variable of interest, the corresponding binary variable (S_{it}), takes the value of 1 if the firm has an internationally recognized certification (and 0 otherwise). By adding this variable to our labour productivity equation, we test whether the adoption and implementation of international standard certification may provide certified firms with a 'productivity bonus'. In line with the debate in the empirical literature, we include a variable for technological innovation (INN_{it}), which takes the value of 1 if the firm has introduced a product or process innovation since the past survey (and 0 otherwise).[12]

We also add firm-related time-varying controls (X_{it}), including (the log of) firm age, the share of sales that corresponds to goods for final consumption, a dummy for legal ownership form (taking the value of 1 if the firm is a joint stock company), a binary variable for the level of capacity utilization (taking the value of 1 if the firm can increase the production from the present level using existing equipment/machinery by more than 50 per cent), and for having received technical assistance from the government during the year before the survey. To account for the fact that competition may influence the effect of standard in some more sophisticated sectors, we also include a sector (2 digit)-level Herfindhal-Hirshman index, which takes values between 0 (with perfect competition) and 1 (monopolistic market concentration). The index is calculated as the sum of squared market shares within each sector from a sample of over 40,000 manufacturing firms from the Viet Nam Enterprise Survey administered by the General Office of Statistics. Finally, we add a set of location (provinces) and sector (at 2–digit level) binary dummies as controls (C_{it}). Controlling for location-related factors with province dummies is relevant, since policies and regulations are implemented at this specific administrative level. We control for time trends by including year dummies.

[12] The questions about innovation relate to product or process innovations and product improvements that have occurred in the past two years. They indicate activities new to the firm, not the market or the world. A firm is considered a product innovator if it has introduced a product in a sector (at the 4-digit level of International Standard Industrial Classification) where it did not have products previously.

Table 1: Definition of variables

Variable	Definition
Standard	= 1 if firm has an international standard.
Productivity (ln)	Sales (in million of Vietnamese Dong VND) per employee, in log. Values refer to the end of the calendar year previous to the survey round.
Capital/Labour (ln)	Capital–labour ratio, in log. Values refer to the end of the calendar year previous to the survey round.
Employment (ln)	Employment, measured by number of full-time workers plus the number of part-time workers, in log. Values refer to the end of the calendar year previous to the survey round.
Firm age (ln)	Firm age, in log.
Technological innovation	= 1 if firm has performed a process and/or product innovation/improvement since last survey.
Training	= 1 if firm normally provides training to new employees.
Professionals (%)	Share of professional employees.
Machines 3 years (%)	Share of machinery that is under 3 years old.
Capacity utilization	= 1 if firm can increase production from the present level by 50 per cent or more.
Final goods (%)	Share of production (in terms of value of sales) for final consumption.
Technical assistance	= 1 if firm has received technical assistance form of government assistance in the previous calendar year.
JSC	= 1 if firm is a joint stock company (without state participation).
HH index	Herfindhal-Hirshman index for market concentration, based on sample of over 40,000 manufacturing firms from the Vietnam Enterprise Survey administered by the General Office of Statistics.
Province	Location dummies for 10 provinces.
Sector	Sector dummies for 18 sectors (2-digit level of International Standard Industrial Classification).

Source: Authors' elaboration.

3.4 Summary statistics

Table 2 presents the basic summary statistics (mean and standard deviation) over different sample compositions (per year, total unbalanced and balanced).

The figures for labour productivity, reported in the first two rows of Table 2, show how this has been stagnating over the considered period. The value of this variable (sales per employee) has been oscillating around the average value for the total unbalanced sample (which corresponds approximately to VND300 million 2010),[13] with a decline in 2013 and a recovery in 2015 but still not reaching 2011 levels.

The proportion of firms with an internationally recognized certification is about 7 per cent (in the whole unbalanced sample). Looking at each time period, there is a decline in the sample frequency of the last period (2015) down to 5.4 per cent. International certifications tend to follow a sectorial pattern, which is persistent across different time periods: between one-quarter and one-third of these certifications concentrate in food and beverages.[14]

The number of employees shows a rather stable pattern, slightly oscillating around the average value of 16.6 across the different periods. More than 70 per cent of the firms in the sample fall

[13] All monetary values are normalized to 2010 VND using the GDP deflator information from World Bank Data.

[14] See Trifkovic (2015) for more details on the sectorial pattern of international standard certifications.

into the category of micro enterprises with less than 10 employees. Regarding capital inputs, the average total assets per employee declined markedly after 2011. Also the share of machinery younger than three years old went down from 17 per cent in 2011 to less than 14 per cent in 2015.

Technological innovation (process innovation, and/or product innovation, and/or product improvement) is much more common than having an international standard, with an average sample frequency of almost 30 per cent over all periods. However, it is important to note a sharp decline in this variable's value since 2011, with a reduction from 46 to less than 20 per cent.

Finally, the sample composition by sectors and provinces (presented in Table A1 in the Appendix) shows a clear concentration of activities in food and beverages (more than 25 per cent of firms) and in the area of Ho Chi Min City (more than 27 per cent of enterprises, which increased to 30 per cent in 2015).

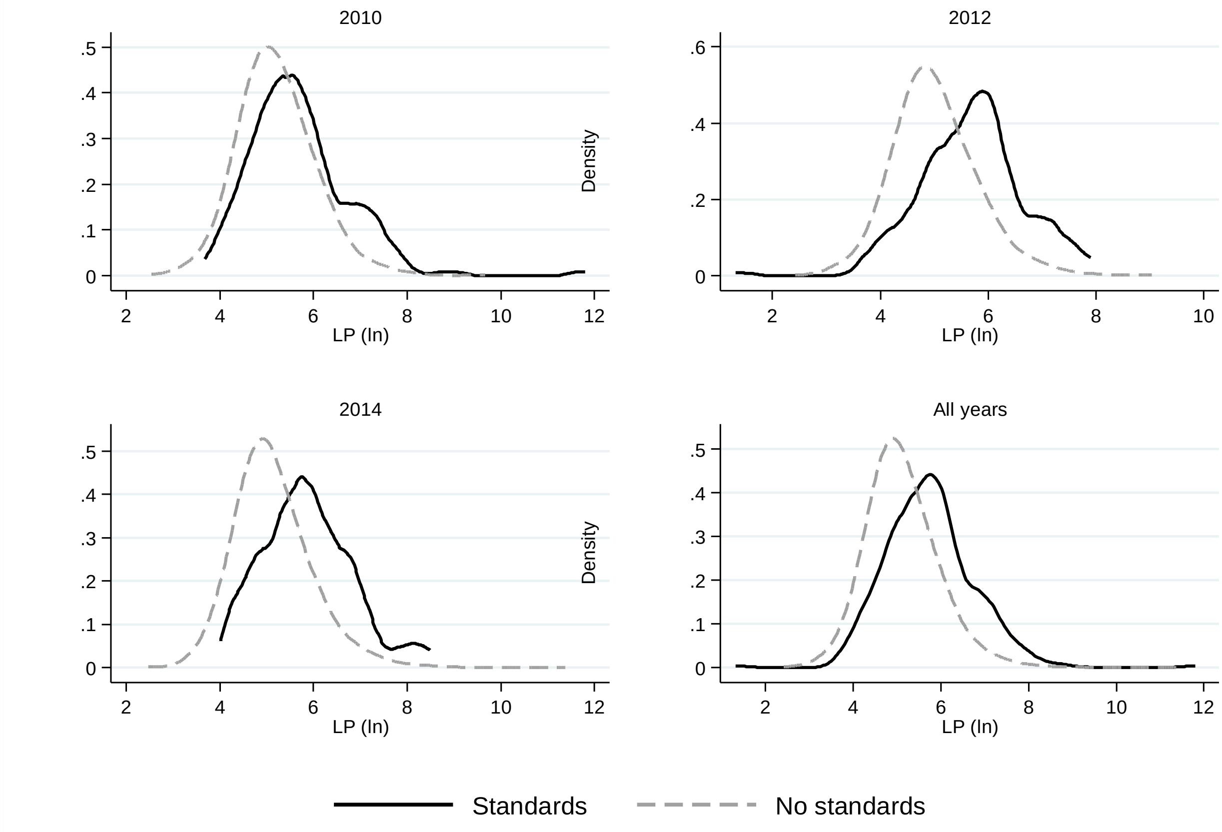
Table 2: Summary statistics

	2011		2013		2015		Total, unbalanced		Balanced	
	Average	SD	Average	SD	Average	SD	Average	SD	Average	SD
Productivity (VND million 2010)	364.56	3,080.59	239.06	372.98	318.79	2,010.66	304.60	2,088.21	340.66	2,820.68
Productivity (ln)	5.25	0.86	5.07	0.82	5.17	0.85	5.16	0.84	5.20	0.82
Standards	7.87	26.94	7.96	27.08	5.37	22.55	7.09	25.67	7.79	26.81
Employment	17.83	30.78	14.79	26.90	17.49	32.24	16.63	29.98	18.22	29.97
Employment (ln)	2.18	1.07	1.96	1.09	2.13	1.07	2.08	1.08	2.24	1.04
Capital/labour (ln)	5.46	1.20	5.11	1.17	5.04	1.14	5.20	1.19	5.29	1.13
Firm age	16.67	8.96	17.12	9.77	15.69	9.82	16.51	9.55	16.90	9.10
Firm age (ln)	2.70	0.47	2.70	0.52	2.57	0.62	2.66	0.54	2.71	0.47
Technological innovation	46.82	49.91	20.43	40.33	18.11	38.52	28.00	44.90	31.59	46.49
Training (%)	8.18	27.42	20.11	40.09	23.48	42.40	17.45	37.95	18.84	39.11
Final goods (%)	32.35	37.63	40.75	39.60	41.65	40.12	38.39	39.37	35.21	38.18
HH index	0.02	0.04	0.02	0.05	0.02	0.06	0.02	0.05	0.02	0.05
Professionals (%)	3.85	6.64	3.56	6.76	3.19	6.77	3.53	6.73	3.83	6.85
Technical assistance	3.21	17.63	2.23	14.77	0.70	8.35	2.04	14.14	2.34	15.13
Machines 3 years (%)	17.01	28.83	15.00	25.97	13.39	25.10	15.11	26.67	14.45	25.46
Capacity utilization	6.01	23.77	7.05	25.61	5.07	21.94	6.08	23.89	5.45	22.70
JSC	4.45	20.63	4.64	21.04	5.52	22.84	4.87	21.52	5.17	22.15
Observations	1,931		2,198		1,993		6,122		3,286	

Source: Authors' calculations based on the SME survey data (CIEM et al. 2016).

Table 3 reports the comparison of means between the two groups of certified and non-certified firms (t-test values are shown in the last column). From the first row, it can be noticed that certified firms have a significantly higher average productivity level. Moreover, not only the level, but also the distribution of productivity looks very different between these two groups also across all periods, as illustrated in Figure 1: the productivity distribution of certified firms always dominates the distribution of non-certified firms, and also presents a less skewed and more regular 'bell shape'.

Figure 1: Kernel density estimation of labour productivity across firms by application of standards



Note: Epanechnikov kernel and bandwidth 0.25.

Source: Authors' elaboration based on the SME survey data (CIEM et al 2016).

Turning to the other variables listed in Table 3, their mean values present large and significant differences between the two groups, with the exception of the share of machinery under three years old. In particular, the sample frequency of technological innovation is almost double in the group of certified firms. This bivariate comparison indicates that certified firms are structurally different to non-certified ones. The main aim of the empirical analysis presented in the following section is to investigate whether, even controlling for these structural differences, international standard certifications still play a significant role in driving the observed differences in productivity performance.

Table 3: Differences in firm characteristics by certification (t-test)

	All	No standards	Standards	Difference (N-B)	t-value
Productivity (ln)	5.16	5.11	5.73	-0.62	14.99***
Technological Innovation	28.00	26.60	46.31	-19.71	8.87***
Employment	16.63	13.46	58.09	-44.63	32.34***
Capital/labour (ln)	5.20	1.97	3.63	-1.67	5.94***
Firm age	16.51	5.17	5.52	-0.35	2.67***
Training	17.45	16.60	15.33	1.27	12.94***
Final goods (%)	38.39	2.66	2.62	0.05	10.37***
HH index	0.02	15.73	39.86	-24.13	2.01**
Professionals (%)	3.53	39.82	19.66	20.16	20.41***
Technical assistance	2.04	0.02	0.02	-0.01	12.89***
Machines 3 years (%)	15.11	3.06	9.68	-6.62	0.50
Capacity utilization	6.08	1.41	10.37	-8.96	2.22**
JSC	4.87	15.06	15.72	-0.66	13.35***
Observations	6,122	5,688	434		

Note: significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Source: Authors' calculation based on the SME survey data (CIEM et al 2016).

4 Results

4.1 The adoption of international standard certifications

Table 4 presents the results for the equation explaining the likelihood for a firm to have an international standard certificate, using different estimation techniques. All variables used in the productivity equations are included.[15] The last two columns show the results for the instrumenting equation, that is the first-stage equation in the 2SLS estimations with the addition of the two instruments.

The results show that the adoption of an international certificate becomes on average more likely with more innovation, larger firm size, and endowment with superior levels of human and physical capital. Having a technological innovation increases the likelihood of having a standard by between 1.5 and 2.3 per cent, depending on the model. A doubling in size corresponds to an increase in the likelihood of having a standard by 2.4 to 8 per cent. Significant positive coefficients of training and the share of professional workers support human capital as determinant of standards adoption. A doubling in capital assets per employee leads to a 1 to 1.8 per cent significant increase in the probability of having a standard. Government technical assistance is also associated with a higher likelihood of adoption. These results are generally in line with what has been found by other empirical works investigating standard adoption (Gebreeyesus 2015; Goedhuys and Mohnen 2017; Goedhuys and Sleuwaegen 2013; Hudson and Orviska 2013), with the difference that we do not find evidence of a significant effect of firm age on the probability of certification. Also share of machinery younger than three years old, share of final goods over total, the HH index for market concentration, and being registered as a joint stock company do not have a significant effect on the likelihood of having a certification. However, some coefficients lose significance in the instrumenting equation estimations (columns 5 and 6), as it is the case for technological innovation.

[15] Time-invariant sector and province controls are excluded from fixed-effect models.

This suggests that the instruments may be capturing some of the impact of technological innovation—for example, if it is the case that firms serving more demanding markets (thus, whose certifications are required by customers) tend also to be more innovative.

Table 4: Determinants of international standard adoption

Dependent variable: Standard certification	(1)▼ Probit, Pooled	(2)▼ Probit, RE (balanced)	(3) LPM, Pooled	(4) LPM, FE (balanced)	(5) 2SLS, Pooled	(6) 2SLS, FE (balanced)
Technological innovation	0.015**	0.018***	0.017**	0.023**	0.003	0.011
	(0.006)	(0.007)	(0.008)	(0.010)	(0.007)	(0.009)
Employment (ln)	0.059***	0.052***	0.081***	0.033**	0.052***	0.024**
	(0.003)	(0.006)	(0.006)	(0.013)	(0.005)	(0.012)
Capital/labour (ln)	0.016***	0.018***	0.013***	0.014**	0.009***	0.005
	(0.003)	(0.004)	(0.003)	(0.007)	(0.003)	(0.006)
Firm age (ln)	0.002	-0.005	0.013**	0.002	0.007	0.006
	(0.006)	(0.010)	(0.006)	(0.022)	(0.006)	(0.019)
Training	0.024***	0.021***	0.046***	0.034**	0.030***	0.027**
	(0.006)	(0.006)	(0.011)	(0.014)	(0.009)	(0.012)
Final goods (%)	-0.000	-0.000	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HH Index	-0.118	0.008	-0.249	-0.095	-0.218*	0.052
	(0.082)	(0.063)	(0.158)	(0.330)	(0.129)	(0.327)
Professionals (%)	0.207***	0.157***	0.335***	0.188*	0.162***	0.089
	(0.034)	(0.042)	(0.073)	(0.096)	(0.060)	(0.079)
Technical assistance	0.047***	0.029**	0.167***	0.079*	0.111***	0.040
	(0.012)	(0.013)	(0.039)	(0.044)	(0.033)	(0.039)
Machinery 3 years (%)	-0.000	-0.000	0.000	-0.000*	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Low capacity utilization	0.010	0.017	0.021	0.020	0.001	0.008
	(0.010)	(0.012)	(0.014)	(0.023)	(0.013)	(0.022)
JSC	0.022**	0.019	0.073**	-0.065	0.050**	-0.082
	(0.010)	(0.012)	(0.028)	(0.067)	(0.025)	(0.078)
IV1: Standard (province-sector share)					0.631***	0.644***
					(0.078)	(0.093)
IV2: Certification required by customers					0.385***	0.295***
					(0.024)	(0.033)
Sector	Yes	No	Yes	No	Yes	No
Province	Yes	No	Yes	No	Yes	No
Year	Yes	Yes	Yes	Yes	Yes	Yes
Constant			-0.199***	-0.088	-0.152***	
			(0.030)	(0.083)	(0.026)	
Observations	6,122	3,286	6,122	3,286	6,122	3,286
Firms	3,065	1,098	3,065	1,098	3,065	1,098
Adjusted R^2			0.21	0.03		

Note: ▼ Marginal effects are reported. For probit coefficients, see Table A2 in Appendix. Standard errors in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Source: Authors' calculations based on the SME survey data (CIEM et al 2016).

4.2 The drivers of labour productivity

The results of the productivity equation are reported in Table 5. The first four columns present the pooled OLS and fixed-effect estimations for unbalanced and balanced samples. Column (1) shows a significant positive impact of standards on productivity when only technological innovation, core observable firm characteristics, and time effects are controlled for. Additional control variables introduced in column (2) only slightly reduce the coefficient size, which remains the same in the OLS estimation on the balanced panel shown in column (3). Column (4) presents the results with firm fixed effects, which account for time-invariant unobservable heterogeneity and confirm a significant positive effect of standards, but with a smaller coefficient than in the case of OLS.

Considering the endogeneity related to the adoption of international standard, we assign the causal interpretation only to the IV estimations in columns 5 and 6. As main result, the variable for standard presents a positive and significant coefficient in both pooled 2SLS and fixed effects (FE) models: having an international standard increases the level of labour productivity between approximately 44 per cent (in pooled 2SLS) and 30 per cent (in 2SLS FE, significant at 10 per cent), on average and all else equal. These results support out main hypothesis that firms with an international standard certification present levels of higher labour productivity than non-certified firms. We interpret this as the impact of better managerial practices related to standard implementation, controlling for the eventual independent effect of technological innovation, training, and other more 'conventional' drivers of labour productivity (such as labour, capital–labour ratio and firm age), among others.

In the IV estimations, the coefficients for international standard are larger than in the pooled OLS and fixed effects estimations, suggesting the presence of a downward bias in the non-IV estimations. Moreover, the results of the 2SLS FE model (column 7) are also not biased by unobserved heterogeneity driven by individual-variant but time-invariant factors. It is also important to note how the unbalanced and balanced panel pooled OLS estimations provide practically the same coefficient for standard and also do not differ much for the other explanatory variables. This offers a further confirmation that the differences in the estimations between pooled and FE models are due to different estimators and not to the type of sample these require.

The null hypotheses that the model is under-identified (Kleibergen-Paap LM test) and that the instruments are weak are both rejected (with p=0.000 in all tests). The values of Kleibergen-Paap Wald F test are larger than the rule-of-thumb value 10, while the values of Cragg-Donald Wald F statistic surpass the Stock-Yogo critical values for weak instruments. Finally, the test for over-identification (Hansen's J) fails to reject the null hypothesis that the instruments are valid, as shown at the bottom of Table 5.

In the 2SLS IV pooled model (column 5), the coefficient of technological innovation is also positive and significant, as are the coefficients of labour and capital–labour ratio. Following the model for the production function presented in section 3, this result suggests the presence of increasing returns to scale of primary inputs (capital and labour), which is not surprising considering the small size of the firms in the sample. The coefficient of firm age is negative and significant. The share of professional workers is significant and positive, reaffirming the importance of qualitative factors in complementing the role of labour as fundamental driver of firm productivity. The effect of technical assistance is also significant (at 5 per cent) and negative. The other control variables are not found to have a significant effect on firm productivity level, including the HH index for market concentration—which is likely to be accounted for by other competition-related factors, such as the controls for sectors. Its sign is negative, which points towards a positive correlation between market competition and performance.

Controlling also for time-invariant unobserved heterogeneity with FE (column 6), firms with a standard certificate, with technological innovation, and a higher capital–labour ratio still enjoy a significantly higher labour productivity level. However, the effects of labour, firm age, and the share of professional workers are no longer significant. In addition, the coefficients of the dummy variables JSC, capacity utilization, and training are not significant. This is not too unexpected: FE models are not very appropriate for assessing the role of variables that change slowly over time with low within-variation, since they tend to level out the effect of these observed quasi-time-invariant factors. Hence, the positive and significant coefficient of the dummy variable for standard even in the 2SLS FE estimation is an indication of the robustness of our finding about the positive 'direct' and 'net' impact of international certifications on labour productivity levels.

Table 5: Drivers of labour productivity

Dependent variable: productivity	(1) OLS, Pooled	(2) OLS, Pooled	(3) OLS, Pooled (balanced)	(4) FE (balanced)	(5) 2SLS, Pooled	(6) 2SLS, FE (balanced)
Standard	0.267***	0.242***	0.242***	0.109*	0.364***	0.266*
	(0.055)	(0.055)	(0.078)	(0.066)	(0.106)	(0.152)
Technological innovation	0.080***	0.081***	0.108***	0.082***	0.078***	0.078***
	(0.024)	(0.024)	(0.032)	(0.028)	(0.024)	(0.028)
Employment (ln)	0.156***	0.154***	0.135***	-0.015	0.144***	-0.020
	(0.013)	(0.015)	(0.023)	(0.051)	(0.017)	(0.051)
Capital/labour (ln)	0.238***	0.227***	0.205***	0.202***	0.225***	0.200***
	(0.011)	(0.012)	(0.018)	(0.022)	(0.012)	(0.023)
Firm age (ln)		-0.094***	-0.109***	-0.061	-0.095***	-0.063
		(0.022)	(0.038)	(0.113)	(0.022)	(0.113)
Training		0.011	0.022	-0.004	0.005	-0.009
		(0.029)	(0.039)	(0.034)	(0.029)	(0.034)
Final goods (%)		-0.000	-0.000	-0.000	-0.000	-0.000
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HH Index		-0.505	-0.707	-0.360	-0.475	-0.343
		(0.481)	(0.795)	(0.567)	(0.482)	(0.566)
Professionals (%)		0.690***	0.859***	-0.098	0.649***	-0.128
		(0.187)	(0.248)	(0.222)	(0.189)	(0.224)
Technical assistance		-0.166**	-0.213**	-0.149*	-0.187**	-0.162*
		(0.081)	(0.092)	(0.085)	(0.082)	(0.086)
Machinery 3 years (%)		0.001	0.001	0.001	0.001	0.001
		(0.000)	(0.001)	(0.001)	(0.000)	(0.001)
Low capacity utilization		0.052	0.030	-0.070	0.050	-0.073
		(0.040)	(0.057)	(0.057)	(0.040)	(0.057)
JSC		-0.074	-0.124	0.168	-0.083	0.179
		(0.066)	(0.092)	(0.224)	(0.066)	(0.228)
Sector	No	Yes	Yes	No	Yes	No
Province	No	Yes	Yes	No	Yes	No
Year	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.546***	3.914***	4.068***	4.307***	3.939***	
	(0.063)	(0.104)	(0.171)	(0.353)	(0.105)	
Observations	6,122	6,122	3,286	3,286	6,122	3,286
Firms	3,065	3,065	1,098	1,098	3,065	1,098
Controls	6	39	39	14	39	15
Adjusted R^2	0.18	0.21	0.18	0.08	0.21	-0.39
Kleibergen-Paap LM statistic					209.652	68.408
Kleibergen-Paap Wald F statistic					186.340	65.250
Cragg-Donald Wald F statistic					831.053	242.193
Hansen J statistic					0.266	1.891
Hansen J statistic p-value					0.606	0.169

Note: Standard errors in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01. Stock-Yogo weak identification test critical value for 10% maximal IV size is 19.93.

Source: Authors' calculations based on the SME survey data (CIEM et al 2016).

Table 6 shows that certification and innovation occur jointly in a large share of firms. Out of all certified firms, 46 per cent in the unbalanced and 53 per cent in the balanced panels reported to have been engaged in innovative activities in the two years prior to the survey. The rate of innovation has slowed down among certified firms since 2011 when 63 per cent of certified firms also reported innovation. The corresponding value in 2015 was 36 per cent. Out of all firms that have innovative outputs, around 12 per cent are certified. Apart from the peak in 2013, the prevalence of certification among the firms that innovate has been around 11 per cent. The strong prevalence of innovation among certified firms could indicate that the effect of standards on productivity could be different depending on the level of innovative activities.

Table 6: Standard and technological innovation

	(1) 2011	(2) 2013	(3) 2015	(4) Total, unbalanced	(5) Balanced
Prevalence of innovation among certified firms	63.16	37.71	36.45	46.31	52.73
Prevalence of standards among innovators	10.62	14.70	10.80	11.73	13.01
Observations	1,931	2,198	1,993	6,122	3,286

Source: Authors' calculations based on the SME survey data (CIEM et al 2016).

In the specifications shown in Table 5, innovation may be endogenous with respect to productivity. This forces us to be cautious in analysing its effect, since it cannot really be interpreted as a causal relationship, but is taken as a control variable. Nevertheless, by way of robustness test and to contribute to the debate on the relationship between standard certifications and technological innovation, we compare the productivity between the sub-samples of innovators versus non-innovators. Results for the pooled OLS and 2SLS (applying the same instruments used in the IV estimations reported in Table 5) are shown in Table 7. The first two columns in Table 7 are for reference, since they report the OLS and 2SLS models for the whole unbalanced panel (repeating columns 2 and 5 from Table 5).

While the magnitude of the significant and positive coefficients for standard does not differ much across the different samples in the pooled OLS models (odd columns), the comparison of the first row of the 2SLS models (columns 4 and 6) reveals a very different story for innovative firms: with a technological innovation, certified firms can enjoy a 'productivity bonus' equivalent to a 69 per cent higher productivity level, as compared to innovating but non-certified firms. The same 'bonus' is reduced to 25 per cent for non-innovating firms (significant at 10 per cent). Given the fact that the firms implementing a technological innovation correspond to less than 30 per cent of the total unbalanced sample, this result is particularly strong, suggesting that the magnitude and significance of the effect of standard found in the total sample (column 2 in Table 7) may be in large part driven by the sub-sample of innovative firms.

In Table A3 in the Appendix, we repeat the exercise of comparing the productivity between innovators and non-innovators but, instead of using sales per employee, we measure labour productivity as value added per employee. The positive effect of standards is in this case observable only for innovators and the magnitude of the effect (38 per cent) is smaller than in the case of sales per employee.

Table 7: Drivers of labour productivity by innovation

Dependent variable: productivity	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS	(5) OLS	(6) 2SLS
	Full sample		Tech. innovators		Non-innovators	
Standard	0.242***	0.364***	0.259***	0.523***	0.233***	0.223*
	(0.055)	(0.106)	(0.081)	(0.160)	(0.070)	(0.135)
Technological innovation	0.082***	0.078***				
	(0.024)	(0.024)				
Employment (ln)	0.154***	0.144***	0.115***	0.089***	0.171***	0.172***
	(0.015)	(0.017)	(0.028)	(0.030)	(0.017)	(0.018)
Capital/labour (ln)	0.226***	0.225***	0.258***	0.252***	0.220***	0.221***
	(0.012)	(0.012)	(0.022)	(0.022)	(0.012)	(0.012)
Firm age (ln)	-0.093***	-0.095***	-0.091**	-0.092**	-0.094***	-0.094***
	(0.022)	(0.022)	(0.040)	(0.040)	(0.025)	(0.025)
Training	0.011	0.005	0.058	0.037	-0.007	-0.007
	(0.029)	(0.029)	(0.058)	(0.060)	(0.033)	(0.033)
Final goods (%)	-0.000	-0.000	-0.001*	-0.001*	0.000	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
HH Index	-0.503	-0.475	-0.001	0.141	-0.691	-0.698
	(0.481)	(0.482)	(0.704)	(0.673)	(0.616)	(0.614)
Professionals (%)	0.689***	0.649***	0.426	0.309	0.773***	0.776***
	(0.187)	(0.189)	(0.301)	(0.303)	(0.231)	(0.232)
Technical assistance	-0.166**	-0.187**	-0.046	-0.086	-0.329***	-0.328***
	(0.081)	(0.082)	(0.107)	(0.109)	(0.122)	(0.123)
Machinery 3 years (%)	0.001	0.001	0.001*	0.001*	0.001	0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
Low capacity utilization	0.049	0.050	0.029	0.020	0.065	0.066
	(0.040)	(0.040)	(0.080)	(0.080)	(0.047)	(0.047)
JSC	-0.074	-0.083	-0.004	-0.006	-0.094	-0.094
	(0.066)	(0.066)	(0.103)	(0.102)	(0.073)	(0.074)
Sector	Yes	Yes	Yes	Yes	Yes	Yes
Province	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Constant	3.916***	3.939***	3.955***	4.021***	3.872***	3.870***
	(0.104)	(0.105)	(0.196)	(0.198)	(0.115)	(0.116)
Observations	6,122	6,122	1,717	1,714	4,410	4,408
Firms	3,065	3,065	1,349	1,347	2,691	2,691
Controls	39	39	38	38	38	38
Adjusted R^2	0.21	0.21	0.24	0.23	0.19	0.20
Kleibergen-Paap LM statistic		209.652		124.504		119.843
Kleibergen-Paap Wald F statistic		186.340		117.754		96.111
Cragg-Donald Wald F statistic		831.053		256.334		531.834
Hansen J statistic		0.266		0.034		0.203
Hansen J statistic p-value		0.606				

Note: Pooled sample. Standard errors in parentheses. Significance levels: * p<0.10, ** p<0.05, *** p<0.01.

Source: Authors' calculations based on the SME survey data (CIEM et al 2016).

5 Discussion

The results presented provide new and original micro-evidence on firm performance in the context of a developing or emerging economy. The originality and novelty of our findings stem from various sources. First, this is one of the first studies showing sound empirical evidence of a positive and significant impact of international standard certifications on the labour productivity of Vietnamese SMEs operating in the manufacturing sector. Moreover, relying on a relatively recent body of managerial literature (Bloom et al. 2013), we directly relate the higher labour productivity of certified firms with the adoption of improved managerial and operational practices implied by standard adherence. We argue that the found significant coefficient for standard provides evidence of a 'direct' and 'net' effect of standard on productivity levels through improved managerial and operational practices, separating it from a possible 'indirect' effect through technological innovation and human resource management.

In fact, international standards being a form of codified knowledge, it is indeed likely that the internal learning processes taking place with the adherence to management standards might favour the development of endogenous capabilities, potentially resulting in more innovation outputs, and, consequently, higher productivity. By including technological innovation in our models, we control also for this additional indirect effect standards may have. Moreover, the effect of standards on human resource management may result in better employment conditions and benefits, including health, safety, and other non-wage benefits. Various studies have indeed documented positive effects of standards on working conditions (Blunch and Castro 2005; Levine and Toffel 2010; Trifković 2015). Our findings are clearly in line with these studies, which help understand the underlying mechanisms of how labour productivity is raised through standards adherence.

Second, thanks to the availability of panel data, our work goes beyond traditional cross-section analyses, thus addressing one of the main limitations of most existing studies for developing countries. The possibility of implementing estimation techniques accounting for endogeneity issues allows ruling out the eventuality that the impact of standard is driven by unobservable factors that affect, at the same time, the decision of standard adoption and the productivity level (e.g. entrepreneurial ability), or by reverse causality. The coefficients for standard obtained in IVs estimations (both pooled 2SLS and FE) are larger than the ones found in OLS, thus pointing towards a downward bias in the OLS estimation. This could arise if unobserved factors correlate positively with the adoption but negatively with productivity, such as, for example, when firms with weaker managerial capabilities seek to improve their performance through standards (Trifković 2015). This is consistent with the finding that firms in developing countries tend to be generally poorly managed (Bloom and Van Reenen 2007, 2010; Bloom et al. 2013), and that the adoption of an international management standard could actually help them upgrade their managerial and operational procedures and ultimately their productivity, especially since surrounding firms are also badly managed and thus cannot represent any better model.

Third, even if this work does not aim to investigate the impacts of standard on innovation outputs, we propose a tentative analysis of this relationship by estimating the productivity equation over split samples of innovators and non-innovators (Tables 7 and A3). The larger positive and significant effect of standards found for innovators leads us to argue that some unobservable factors associated with technological innovation may reinforce the positive effect of standard on productivity. Our results seem to suggest that, even controlling for their skills and human capital, innovative firms may be able to better implement the managerial and operational improvements required by standard adherence, thus obtaining more advantages in terms of efficiency gains than non-innovating certified firms.

Finally, the analysis of the first-stage equation (Table 4) also provides some additional indications about which factors may affect standard adoption among Vietnamese SMEs. In general, our results are consistent with the literature on the cost of adopting and implementing an international standard certification (Kaplinsky 2010). The positive effects of capital (only in the 2SLS pooled model) and of firm size seem to point towards this direction, with the wealthiest and larger firms being better able to bear the costs of getting a certificate. Also the significant positive effect of the variable for government technical assistance may serve to support this argument further. Different to most of the empirical literature on standard adoption, we do not find a significant effect of firm age. However, the sign of age in pooled models shows a positive correlation between age and standard, which may again indicate that younger firms—which typically face the so-called 'liability of newness'—are less likely to dispose of sufficient resources to adopt and implement an international standard.

6 Concluding remarks

This work presents original findings on the effects of the adherence to international management standards on firm productivity in the Vietnamese manufacturing sector. Besides contributing to enrich the relevant empirical literature, these findings may have some relevant implications for the performance of micro, small, and medium enterprises in the Vietnamese manufacturing sector. Viet Nam's manufacturing sector bears contemporary similarities to a large number of developing countries, which makes the findings highly relevant for other regional and extra-regional stakeholders.

By providing new evidence on the impact of international certifications on productivity at the micro level, our results further support the argument that 'stimulating adherence to world standards may be important component in industrial policy' (Goedhuys and Mohnen 2017:13), especially in the attempt to move forward from capital-intensive growth strategies, such as could be the case for Viet Nam and for other Asian emerging economies. Moreover, our work also suggests that targeting support towards innovative firms in applying and obtaining certifications may provide a larger contribution to raising productivity, given the fact that these firms seem to benefit relatively more from standard adherence.

The design and implementation of policy interventions aimed at fostering certification should also take into account the empirical evidence regarding what makes it more likely for a firm to be certified. In this respect, our results are consistent with many studies on adoption, agreeing on the fact that the cost of standards still represents a relevant barrier, especially for SMEs. Facilitating certification by lowering its direct and indirect costs may be an effective tool to foster productivity among micro and small enterprises. However, these initiatives should go beyond sole financial support and include interventions aiming at informing about the benefits of certification standards and about how to successfully apply for them.

We are aware of the limitations of this work, as well as of the possible areas for future research arising from trying to overcome these same limitations. Some limitations are related to variables construction and availability. Given the majority of micro firms in our sample, the use of labour productivity as sales per employee could generate to an overestimation of the performance of very small firms with respect to small ones. A way to test our analysis would be to use other performance indicators as dependent variable, such as sales or employment growth. Moreover, the limited information on the year of certification does not allow us to control for when the standard has been obtained over time, which could help improve the interpretation of our results and sharpen the analysis on the relationship between innovation, standards, and productivity.

We also acknowledge that the proposed comparison of the effect of standard certification for innovating and non-innovating firms does not allow us to properly disentangle the mechanisms through which their relationship affects productivity. Further empirical research would be needed to shed more light on the interplay between these two factors and their ultimate effect on firm productivity. Finally, like most of the existing empirical studies, we concentrate on the family of international management standards, mainly ISO 9001 (and, to a lesser extent, ISO 14001). Future studies could distinguish and estimate the effect of different types of standards, for example product standards and environmental regulations, and also take into account that domestic and local standards may matter even more for SMEs or serve as an intermediate step to acquire knowledge on world class practice in management of production processes.

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Appendix

Table A1: Sample composition by sector and location

	2011		2013		2015		Total, unbalanced.		Balanced	
	Share	SD	Share	SD	Share	SD	Share	SD	Share	SD
Sectors										
Food and beverages	0.248	0.43	0.293	0.46	0.245	0.43	0.263	0.44	0.242	0.43
Textiles	0.037	0.19	0.035	0.19	0.032	0.18	0.035	0.18	0.033	0.18
Apparel	0.058	0.23	0.050	0.22	0.058	0.23	0.055	0.23	0.053	0.22
Leather	0.023	0.15	0.021	0.14	0.024	0.15	0.023	0.15	0.020	0.14
Wood	0.093	0.29	0.095	0.29	0.115	0.32	0.101	0.30	0.106	0.31
Paper	0.033	0.18	0.030	0.17	0.028	0.16	0.030	0.17	0.029	0.17
Publishing and printing	0.029	0.17	0.027	0.16	0.039	0.19	0.031	0.17	0.028	0.17
Refined petroleum	0.003	0.06	0.004	0.06	0.004	0.06	0.004	0.06	0.005	0.07
Chemical products	0.019	0.14	0.023	0.15	0.023	0.15	0.022	0.15	0.019	0.14
Rubber	0.056	0.23	0.059	0.24	0.077	0.27	0.064	0.24	0.077	0.27
Non-metallic mineral products	0.054	0.23	0.043	0.20	0.043	0.20	0.047	0.21	0.050	0.22
Basic metals	0.018	0.13	0.012	0.11	0.013	0.11	0.014	0.12	0.013	0.11
Fabricated metal products	0.196	0.40	0.183	0.39	0.195	0.40	0.191	0.39	0.199	0.40
Electronic machinery	0.036	0.19	0.030	0.17	0.028	0.17	0.031	0.17	0.030	0.17
Motor vehicles etc.	0.008	0.09	0.005	0.07	0.006	0.08	0.007	0.08	0.009	0.09
Other transport equipment	0.004	0.06	0.004	0.06	0.003	0.05	0.004	0.06	0.002	0.05
Furniture	0.086	0.28	0.085	0.28	0.069	0.25	0.080	0.27	0.085	0.28
Recycling	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00	0.000	0.00
Provinces										
Ha Noi	0.131	0.34	0.124	0.33	0.129	0.34	0.128	0.33	0.138	0.34
Phu Tho	0.079	0.27	0.082	0.27	0.062	0.24	0.074	0.26	0.058	0.23
Ha Tay	0.128	0.33	0.138	0.34	0.128	0.33	0.132	0.34	0.130	0.34
Hai Phong	0.096	0.29	0.078	0.27	0.090	0.29	0.088	0.28	0.087	0.28
Nghe An	0.097	0.30	0.127	0.33	0.089	0.28	0.105	0.31	0.079	0.27
Quang Nam	0.065	0.25	0.065	0.25	0.062	0.24	0.064	0.25	0.067	0.25
Khanh Hoa	0.047	0.21	0.040	0.19	0.043	0.20	0.043	0.20	0.046	0.21
Lam Dong	0.032	0.17	0.039	0.19	0.042	0.20	0.038	0.19	0.036	0.19
HCMC	0.269	0.44	0.257	0.44	0.310	0.46	0.278	0.45	0.301	0.46
Long An	0.058	0.23	0.050	0.22	0.045	0.21	0.051	0.22	0.057	0.23
Observations	1,935		2,199		1,993		6,127		3,289	

Source: Authors' calculations based on the SME survey data (CIEM et al 2016).

Table A2: Determinants of international standard adoption—probit coefficients in columns 1 and 2

Dependent variable: Standard certification	(1) Probit, Pooled	(2) Probit, RE (balanced)	(3) LPM, Pooled	(4) LPM, FE (balanced)	(5) 2SLS, Pooled	(6) 2SLS, FE (balanced)
Technological innovation	0.167**	0.352***	0.017**	0.023**	0.003	0.011
	(0.071)	(0.128)	(0.008)	(0.010)	(0.007)	(0.009)
Employment (ln)	0.680***	1.032***	0.081***	0.033**	0.052***	0.024**
	(0.039)	(0.091)	(0.006)	(0.013)	(0.005)	(0.012)
Capital/labour (ln)	0.182***	0.367***	0.013***	0.014**	0.009***	0.005
	(0.033)	(0.073)	(0.003)	(0.007)	(0.003)	(0.006)
Firm age (ln)	0.017	-0.097	0.013**	0.002	0.007	0.006
	(0.075)	(0.191)	(0.006)	(0.022)	(0.006)	(0.019)
Training	0.274***	0.416***	0.046***	0.034**	0.030***	0.027**
	(0.069)	(0.128)	(0.011)	(0.014)	(0.009)	(0.012)
Final goods (%)	-0.000	-0.002	0.000	-0.000	0.000	-0.000
	(0.001)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
HH Index	-1.354	0.166	-0.249	-0.095	-0.218*	0.052
	(0.940)	(1.248)	(0.158)	(0.330)	(0.129)	(0.327)
Professionals (%)	2.380***	3.121***	0.335***	0.188*	0.162***	0.089
	(0.392)	(0.811)	(0.073)	(0.096)	(0.060)	(0.079)
Technical assistance	0.544***	0.588**	0.167***	0.079*	0.111***	0.040
	(0.133)	(0.257)	(0.039)	(0.044)	(0.033)	(0.039)
Machinery 3 years (%)	-0.001	-0.004*	0.000	-0.000*	-0.000	-0.000
	(0.001)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)
Low capacity utilization	0.110	0.341	0.021	0.020	0.001	0.008
	(0.117)	(0.234)	(0.014)	(0.023)	(0.013)	(0.022)
JSC	0.250**	0.374	0.073**	-0.065	0.050**	-0.082
	(0.112)	(0.232)	(0.028)	(0.067)	(0.025)	(0.078)
IV1: Standard (province-sector share)					0.631***	0.644***
					(0.078)	(0.093)
IV2: Certification required by customers					0.385***	0.295***
					(0.024)	(0.033)
Sector	Yes	No	Yes	No	Yes	No
Province	Yes	No	Yes	No	Yes	No
Year	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.287***	-7.445***	-0.199***	-0.088	-0.152***	
	(0.338)	(0.865)	(0.030)	(0.083)	(0.026)	
Observations	6,142	3,294	6,142	3,294	6,122	3,286
Firms	3,070	1,098	3,070	1,098	3,065	1,098
Adjusted R^2			0.21	0.03		

Source: Authors' calculations based on the SME survey data (CIEM et al 2016).

Table A3: Drivers of labour productivity (value added over employees) by innovation

Dependent variable: VA/Employments	(1) OLS	(2) 2SLS	(3) OLS	(4) 2SLS
	Innovators		Non-innovators	
Standard	0.135**	0.320**	0.096*	0.164
	(0.060)	(0.125)	(0.050)	(0.108)
Log (employment)	0.110***	0.091***	0.187***	0.182***
	(0.021)	(0.023)	(0.014)	(0.015)
Log (capital/labour)	0.163***	0.158***	0.144***	0.143***
	(0.016)	(0.016)	(0.010)	(0.010)
Log (firm age)	-0.098***	-0.099***	-0.097***	-0.098***
	(0.030)	(0.030)	(0.021)	(0.021)
Training	0.067	0.052	0.022	0.020
	(0.044)	(0.045)	(0.026)	(0.026)
Final goods (%)	-0.000	-0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
HH Index	0.242	0.345	-0.148	-0.143
	(0.429)	(0.417)	(0.489)	(0.489)
Professionals (%)	0.538**	0.458**	0.326*	0.309*
	(0.220)	(0.222)	(0.177)	(0.178)
Technical assistance	-0.021	-0.048	-0.255***	-0.266***
	(0.078)	(0.081)	(0.095)	(0.097)
Machinery 3 years (%)	0.001	0.001	0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.000)
Low capacity utilization	-0.022	-0.028	0.019	0.021
	(0.069)	(0.069)	(0.039)	(0.039)
JSC	-0.019	-0.020	-0.009	-0.017
	(0.072)	(0.071)	(0.055)	(0.055)
Sector	Y	Y	Y	Y
Location	Y	Y	Y	Y
Year	Y	Y	Y	Y
Constant	3.413***	3.458***	3.198***	3.209***
	(0.142)	(0.143)	(0.091)	(0.093)
Observations	1,708	1,705	4,373	4,371
Firms	1,347	1,345	2,679	2,678
Controls	38	38	38	38
Adjusted R^2	0.25	0.25	0.23	0.23
Kleibergen-Paap Wald F statistic		115.349		93.710
Hansen J statistic		0.461		0.419
Hansen J statistic p-value		0.497		0.517

Source: Authors' calculations based on the SME survey data (CIEM et al 2016).