Certification and business risk

Neda Trifkovic*

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United Nations University World Institute for Development Economics Research

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Abstract: The purpose of this paper is to investigate the scope for international private standards to play a role in reducing business risk. Business risk is measured as variability in revenue, customer base, informal payments, and temporary firm closure. The results show lower levels of business risk among certified firms, especially for firms in the middle deciles of the risk distribution. Certification also correlates negatively with risk-reduction for technologically advanced firms, as well as firms located in rural areas and northern provinces of Vietnam. The results suggest that firms could find protection from business downsides by investing in quality management tools.

* University of Copenhagen, Denmark, email: neda.trifkovic@econ.ku.dk.

1 Introduction

This paper investigates the scope for international private standards to play a role in reducing business risk. Standards are measures by which products, processes and producers are judged (Hatanaka et al. 2005). Different products are subject to information asymmetry problems, because consumers cannot easily verify all the quality characteristics before the purchase. It is, for example, difficult to ascertain by looking at the product, whether it is grown organically or whether responsible labour, trade, environmental or animal welfare practices have been followed (Lee et al. 2010). Trade globalization is making the communication about product attributes even more complex, as the consumption and demand for more product information take place in high-income countries, while the production takes place in developing countries with usually different levels of public regulation stringency. Standards and certification schemes address the need for more information by signalling specific attributes of, for example, product quality and safety or social and environmental aspects of production processes. Signalling is usually a part of a firm's strategy to raise its credentials in the marketplace, indicate reliability, and increase consumers' trust (Fulponi 2006; Henson and Jaffee 2006; Terlaak and King 2006).

The literature on standards in the context of transition economies and developing economies has mainly analysed the emergence of international standards for safety, quality and sustainability as a new global regulation mode (Hatanaka et al. 2005; Henson and Reardon 2005). Even though the results are still ambiguous, this stream of research highlights the trade-facilitating effects of international standards (Beghin et al. 2015). Standards give an opportunity for firms in emerging economies to increase access to international markets and to raise their productivity and sales performance (Calza et al. 2017; Goedhuys and Sleuwaegen 2013; Henson et al. 2011; Masakure et al. 2009; Trifković 2016). The ability of standards to increase firm productivity comes from modifications in internal practices, streamlining procedures, and improving workplace conditions (Calza et al. 2017; Delmas and Pekovic 2013; Levine and Toffel 2010; Trifković 2017). These processes can also reduce uncertainty and the risk of supplying inferior goods to the market. This argument has been put forward in several studies (Antle 1996; Terlaak and King 2006; Henson and Reardon 2005), but the possibility of risk-reducing benefits of standards have not been empirically tested.

Risk is defined as the potential for financial loss or physical damage associated with a business activity (Chapman and Cooper 1983). Future financial returns can be subject to unpredictable processes, but they can also depend directly on the firm's activities, such as investment decisions. The primary measure of business risk in this paper is variability in revenue from three main products over time. The choice of the measure is consistent with earlier empirical work (Gomez-Mejia et al. 2001; Henkel 2009; Ruefli et al. 1999). If one part of the firm's revenue variability comes from a low ability to assure product quality and safety, then standards can stabilize year-to-year revenue by reducing cases of malfunctioning and discarded or contaminated products. Additional measures of business risk include customer risk, based on the variability in the customer base, informal payments and temporary business closure.

The results based on a sample of small- and medium-sized enterprises from Viet Nam show lower levels of business risk among certified firms. Heterogeneity analysis confirms the result for middle deciles of the risk distribution and location differences in favour of firms located in rural areas and northern provinces. Certification is also a useful risk-reduction tool for technologically advanced firms. The overall conclusion of benefits from standards also holds for alternative risk measures, namely customer risk, informal payments, and temporary business closure. Certification is found to correlate negatively with customer risk, informal payments and temporary business closure.

Estimations account for bias from unobservable time-invariant heterogeneity, suggesting that firms could find protection from business downsides by investing in activities that go beyond minimal regulatory compliance.

2   Key concepts and literature

The literature distinguished three ways of obtaining information about products and therefore three types of goods (Darby and Karni 1973; Nelson 1970). Search goods are those for which consumers have perfect information before purchase (such as colour, shape or size), but for other goods it may be difficult to have full information beforehand. Products whose attributes are revealed only after the consumption (such as taste) are called experience goods, and products whose quality can be determined only with necessary expert knowledge are credence goods. For example, pathogens that present food safety hazards or cancer-causing toxins cannot be identified prior to the purchase. Instead, consumers may become aware of them at the onset of illness. As a consequence, the imperfect information in product markets will lead to an inefficient level of food quality and safety, and lower quality products will dominate (Akerlof 1970). Under these conditions of asymmetric information, sellers know the product quality and they can signal higher product quality with higher price. However, as the higher price strategy undermines the price competition (Antle 1996), sellers are increasingly aiming to remove the uncertainty about product attributes by making the information available to consumers, most commonly through product labelling or certification in accordance with international standards.

Standards are an increasingly important governance mechanism in global production and trade between developed and developing countries (Ponte and Gibbon 2005). They were traditionally devised and enacted by individual governments, with the intention to shape the market environment and influence the behaviour of the concerned actors (Blind et al. 2017). With the increasing trade globalization—where production occurs in various locations and under different sets of rules and conditions—the standard-setting role of governments is taken over by various non-governmental, international, and private regulatory bodies. Private standards are thus developed by coalitions of private sector actors (Henson and Humphrey 2010) and enforced by third-party certification (Hatanaka et al. 2005). Focusing on a variety of quality attributes that are not stipulated by public regulation, private standards are deemed more stringent and more comprehensive than public regulation (Farina et al. 2005; Reardon and Berdegué 2002).

Since the early 1990s, standards have been a way of responding to the requests for specific product attributes, commonly transferred from consumers to producers. ISO 9001 is the most commonly used international standard. The International Organization for Standardization (ISO) published the ISO 9001 standard in 1987, as a framework for quality management from manufacturing to delivery. Many firms have adopted the ISO 9001 standard as a way of meeting the demands of global competition (Manders et al. 2016). The process of implementing the ISO 9001 standard and certification can be quite expensive, but the cost seems justifiable to many firms across the globe. The ISO Survey (ISO 2016) shows that more than one million organizations in 187 countries have ISO 9001 standard certification. The second most commonly applied standard is ISO 14001, implemented to improve environmental management practices of firms. ISO 22000 is implemented for the purpose of managing food safety risks, which is particularly relevant for the food industry.

Standards and certification schemes assure credibility of the production process and inform about product quality and safety, as well as about the social and environmental conditions of the production process. This illustrates the signalling role of standard certificates, which are used

strategically to raise the firm's credentials in the marketplace by indicating to external parties that the firm is a reliable supplier and partner (Goedhuys and Sleuwaegen 2013; Henson and Jaffee 2006; Potoski and Prakash 2009; Terlaak and King 2006). One of the signalling benefits is the reduction in transaction and search costs, that is, the time and resources customers need to identify eligible suppliers. Another benefit is the ability of certified firms to address competitive pressures by shifting from price-based competition to quality-based competition and from undifferentiated commodities to value-added differentiated goods (Henson and Reardon 2005). Such product differentiation can increase profits (e.g. Spence 1976; Tirole 1988). A particularly relevant aspect of quality-based competition for producers from developing countries is using certificates as a way to differentiate themselves from informal sector producers (Jaffee and Masakure 2005).

Apart from the signalling effect, standard certification could lead to internal benefits for firm performance. Implementation of private standards such as ISO 9001 usually requires putting in place a set of planning, controlling and corrective activities, such as, for example, i) examining adequacy of work processes and methods for meeting product specifications; ii) documenting work processes, work instructions, and quality assurance procedures; iii) internal auditing to verify that activities comply with the procedures; and iv) designing preventive and applying corrective actions in response to audits (Naveh and Erez 2004). Studies link certification with process and product upgrading, better managed production procedures and business practices, increased monitoring, increased efficiency in the use of resources, and reduction of waste and pollution, as evidenced in a number of studies (González et al. 2008; Iraldo et al. 2011; Goedhuys and Sleuwaegen 2013). Improved control and increased efficiency can, in turn, create competitive advantage (Caswell et al. 1998; Henson and Caswell 1999).

The internal benefits can also be generated through an effect on human resources. Successful standard implementation is difficult without investments in human capital. Building employee skills and capabilities through training and improving workplace safety and satisfaction may contribute to better working conditions and consequently to higher productivity (Delmas and Pekovic 2013; Levine and Toffel 2010; Trifković 2017).

Enterprises face several types of risk. For example, strategic risk affects the implementation of a particular business strategy, operational risk disrupts core processing capabilities, customer risk affects the likelihood of customers placing orders, financial risk arises from changing financial markets or debtor defaults, while reputation risk erodes the value of the whole business due to loss of confidence (Harland et al. 2003; Simons 1999; Smallman 1996). The sources of risk can be direct and indirect. Human, organizational and technological activities can directly cause business crises, while regulatory, infrastructural, and political factors can contribute indirectly (Smallman 1996). Conditions of the natural environment can also be counted as indirect risk factors as they are beyond the organization's and individuals' influence. Risks affect businesses negatively, causing financial, performance, physical, psychological, social, or time loss (Harland et al. 2003). Risks should be managed, when doing so improves the expected value of outcomes or if the potential damage of events exceeds what the firm finds acceptable (Bromiley et al. 2016).

While risk can refer to the firm's preferences, behaviour or actions, the focus here is on the outcomes of risk.[1] Literature is far from unified in providing guidance on how to measure risk, but one of the proposed ways is to use information on variability in actual firm performance, which

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[1] Bromiley et al. (2017) offer a summary of different connotations of risk.

reflects uncertainty about the firm's income stream due to its particular decisions or activities.[2] If one part of the firm's revenue variability comes from a lack or limited ability to assure product quality and safety, standards could serve as a risk-reducing tool and stabilize revenue levels over time. This effect could come from obtaining better insight into the firm's processes and preventing undesired events such as cases of malfunctioning and discarded or contaminated products.

3   Data

The analysis is based on the data from the biannual small- and medium-sized enterprise (SME) survey for Viet Nam. This survey has been conducted in 10 provinces in Viet Nam: Ho Chi Minh City (HCMC), Hanoi, Hai Phong, Long An, Ha Tay, Quang Nam, Phu Tho, Nghe An, Khanh Hoa and Lam Dong. The sampling frame comprises a consolidated list of formal enterprises obtained from the Establishment Census from 2002 (GSO 2004) and the Industrial Survey 2004–06 (GSO 2007). Firms are randomly drawn from this list, accounting for ownership type to obtain representative data on household-owned, private, cooperative, limited liability and joint stock enterprises. Apart from the officially registered firms, the survey also includes informal firms that were identified randomly on-site.[3] As the survey traces the same firms over the years, it is able to capture legal structure changes and formalization of unregistered businesses. Firms who stop operating are randomly replaced based on the need to maintain a constant level of household firms based on the information in GSO (2004) and the new 2014 population of firms registered under the Law on Enterprises obtained from GSO (2015).

The analysis in this paper is based on the data from the 2011, 2013 and 2015 survey rounds, because the question about the compliance with internationally recognized standards was introduced in 2011. The survey targets non-state manufacturing enterprises from different sectors. Informal businesses are unlikely to obtain a certificate of compliance with standards, as the main information on the certificate is precisely the firm registration number. That is why informal firms are excluded from the analysis. The total sample used in the analysis thus comprises 4,728 firms; 1,377 firms in 2011, 1,363 in 2013 and 1,988 in 2015.

The main questionnaire includes information on enterprise characteristics and practices. All questions refer to the situation in the previous calendar year, namely 2010, 2012 and 2014, while the economic accounts contain information on two consecutive years prior to the survey. The questionnaire has stayed almost the same over the years, with the exception that the questionnaire from 2015 separately asks about international and domestic standards. The 2011 and 2013 survey rounds only contain an indicator for whether firms have applied for any of the internationally recognized standards, while the 2015 round reveals exactly which standards are certified.

3.1   Descriptive statistics

Summary statistics in Table 1 show average values and standard deviations of key dependent and control variables. The first three rows show average values of annual revenue in million Vietnamese Dong for three main products. The values are deflated for spatial and temporal differences in the cost of living in different areas of Viet Nam. Firms were asked in the interviews to identify the most important products in value terms. As the majority of firms are micro or small,

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only 65 per cent produce more than one product. The consequence is that the first most important product contributes the most to the value of the business risk variable, whose average value has been steadily increasing in the observed six-year period. Informal payments and the incidence of temporary closures have in contrast decreased in the observed period. Customer risk, measured as variation in the customer base, has not changed much between 2011 and 2015, indicating on average a fairly stable customer portfolio.

The proportion of firms with internationally recognized private standards in the sample is 7.7 per cent. This average masks a large drop between 2013 and 2015, where the proportion of certified firms declined from 10 to 4.6 per cent. This is similar to the observed twofold decline in the total number of ISO 9001 certificates in Viet Nam that decreased from 6,164 in 2012 to 3,786 in 2014 (ISO 2016).[4] The most commonly certified standards among the Vietnamese SMEs are ISO 9001, ISO 14001 and ISO 22000. Figure 1 shows how important different contacts were for deciding whether to adopt standards. The most important input in the certification decision comes from customers and surprisingly also from suppliers. The former case indicates that certification works through signalling desirables attributes of a product or a production process and it is well-described in the literature (Henson and Humphrey 2010; Fouayzi et al. 2006). The latter case is likely to occur for more technically advanced products or vertically integrated value chains, where quality needs to be assured in downstream operations, such as, for example, in the case of different assembly activities.

Figure 1. How important were the following contacts for your decision to implement standards? (Scale 0–7)
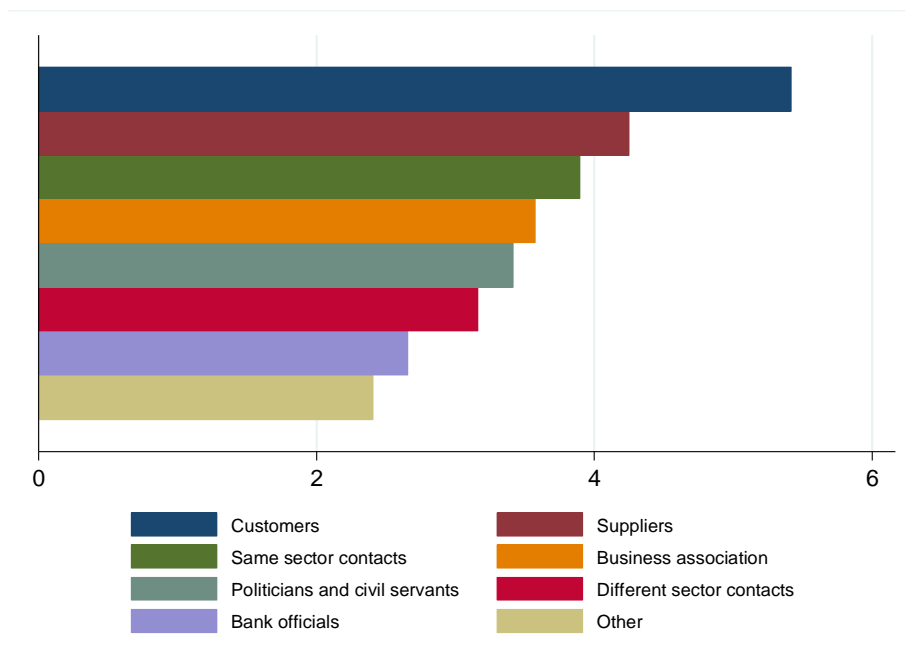
Source: Author's illustration based on the SME data.

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[4] In addition to the general declining trend of certification in Viet Nam, there is a small possibility that the drop in the number of certified firms in 2015 could be due to the change in the questionnaire. Whereas the 2011 and 2013 survey rounds asked about certification against internationally recognized standards, the 2015 round asked in addition about domestic standards. The wording of the question about internationally recognized standards has remained the same, but it has perhaps offered a possibility for some respondents to more carefully reflect on the type of the certification they have. Another reason could be that companies reached a point when they needed to re-certify and could not fulfil stricter conditions of re-certification.

Table 1 also shows that the average firm size is about 17 employees. Micro firms, defined as those with less than 10 employees, comprise 60 per cent of the sample. One half of that fraction are small firms and the rest are medium firms, employing between 50 and 300 employees. The average firm size has declined between 2011 and 2015, which is in line with the general trend of declining firm size in Viet Nam (CIEM et al. 2014). Table 1 also shows a declining value of the capital-labour ratio. About 8 per cent of firms from the sample export and this proportion has remained unchanged over time.

In terms of owner or manager characteristics, about three-quarters have completed at least upper secondary school. About 41 per cent of firms are owned or managed by women. The proportion of women in this role has been declining since 2011. Around 40 per cent of enterprises belong to sectors characterized by low intensity of technology: food and beverages, textiles, apparel, leather, wood processing and recycling. Slightly more than half of the sample are enterprises from rural areas, defined as locations different from Hanoi, Ho Chi Minh City and Hai Phong.

Table 1. Summary statistics of key variables

|	All years		2011		2013		2015	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Revenue 1st product	0.192	7.72	0.037	0.63	0.534	14.01	0.049	0.32
Revenue 2nd product	0.716	2.15	0.129	0.66	1.008	2.55	0.932	2.43
Revenue 3rd product	0.310	1.02	0.048	0.28	0.460	1.21	0.392	1.18
Business risk (ln)	1.074	0.35	1.102	0.34	1.041	0.36	1.078	0.35
Customer risk (ln)	1.310	0.46	1.322	0.46	1.263	0.46	1.338	0.46
Informal payments (%)	49.73	50.00	52.25	49.96	52.89	49.93	45.50	49.81
Temporary closure (%)	12.21	32.75	12.59	33.18	12.82	33.44	11.48	31.89
Certification (%)	7.67	26.62	9.34	29.11	10.10	30.15	4.61	20.98
Firm size	17.50	31.02	19.88	32.79	18.01	29.61	15.36	30.58
Capital-labour ratio	0.476	0.80	0.544	1.05	0.493	0.66	0.413	0.66
Export (%)	7.64	26.56	7.74	26.73	7.91	27.00	7.35	26.10
Post-secondary education (%)	74.91	43.36	71.63	45.09	78.29	41.24	74.77	43.44
Female owner or manager (%)	40.63	49.12	39.18	48.83	41.80	49.34	40.80	49.16
Household establishment (%)	54.01	49.84	50.89	50.01	49.77	50.01	59.50	49.10
Private/sole proprietorship (%)	9.49	29.31	11.17	31.51	11.03	31.33	7.09	25.67
Partnership/Collective/Cooperative (%)	2.94	16.88	3.72	18.94	3.06	17.23	2.26	14.87
Limited liability company (%)	28.29	45.04	28.90	45.34	30.31	45.97	26.32	44.04
Joint stock company (%)	5.28	22.36	5.32	22.45	5.83	23.44	4.83	21.44
Observations	5,723		1,692		1,732		2,299	

Note: Real revenue and capital values are in million Vietnamese Dong (VND). 1 USD ≈ 20,000 VND. The number of firms with revenue information for two products is 2,183 (3,770 observations) and the number of firms with revenue information for three products is 1,591 (2,583 observations).

Source: Author's calculation based on the SME data.

Comparing the enterprises from the sample by certification, the first aspect to observe is a significant difference in revenue between certified and non-certified firms, as shown in Figure 2. The Kolmogorov-Smirnov test statistic is 0.43, indicating that the distributions of revenue in certified and non-certified firms are statistically different (p = 0.00). Moreover, certified firms have significantly lower business and customer risk value, as shown in Table 2. These firms have much lower incidence of temporary firm closure, but higher incidence of informal payments, perhaps due to higher visibility. Certified firms have a higher capital value, indicating that they could be

more technologically advanced than non-certified firms. These firms are also much more likely to export than non-certified firms and to be managed by women who tend to be better educated than owners or managers of non-certified firms.

Figure 2. Differences in revenue for the three most important products by certification
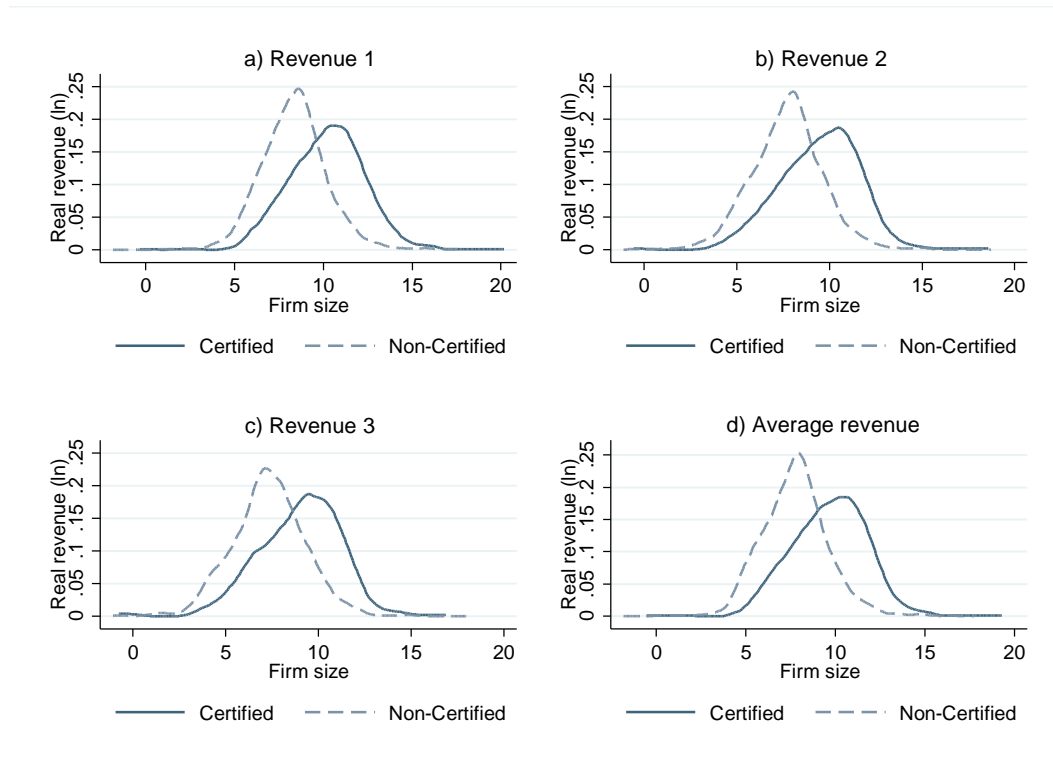
Source: Author's calculation based on the SME data

Table 2. Differences between firms by certification (t-test)

	(1) Non-certified	(2) Certified	(3) Difference (N-C)	(4) t-value	(5) Observations
Business risk (ln)	1.08	0.97	0.11	6.63***	5,723
Customer risk (ln)	1.33	1.06	0.27	11.91***	5,723
Informal payments (%)	48.69	62.19	-13.49	-5.45***	5,723
Temporary closure (%)	12.74	5.92	6.81	4.20***	5,723
Firm size	14.12	58.13	-44.01	-30.84***	5,723
Capital-labour ratio	0.47	0.61	-0.14	-3.57***	5,723
Export	4.96	39.86	-34.90	-28.24***	5,723
Post-secondary education	73.05	97.27	-24.22	-11.37***	5,723
Female owner or manager	39.53	53.76	-14.22	-5.85***	5,723

Source: Author's calculation based on the SME data

4   Estimation

The main goal is to estimate the effect of certification on business risk over the period 2011–15. The estimation follows the form specified in the following equation:

$$y_{ijt} = \alpha_i + \beta_i C_{it} + \delta X_{it} + \rho_j + \tau_t + e_{ijt}$$

where i denotes firm, j denotes location and t denotes time period. a_i, are firm fixed effects and e_{ijt} is the statistical noise term. The dependent variable, y_{ijt} is business risk. Following Ruefli et al. (1999) and Gomez-Mejia et al. (2001), it is defined as performance variance relative to performance level, where performance is measured as revenue. The revenue values are spatially and temporally deflated using spatial cost of living indices for different years and provinces of Viet Nam. The risk is calculated as the logarithm of the ratio of the variance in revenue for the three most important products, $k = 1, 2, 3$ divided by a term consisting of the average revenue minus the minimum revenue squared:

$$y_{ijt} = \ln\left(\frac{r_{\text{var},ikt}}{(r_{\text{av},ikt} - r_{\text{min},ikt})^2} \right)$$

Other things being equal, the more the average revenue for a given period exceeds the minimum revenue, the term in the denominator increases, and business risk decreases accordingly. Conversely, as the variance in the revenue (the numerator) increases, business risk increases accordingly. This index is similar to the coefficient of variation, which is positively related to the variance of performance outcomes over time and negatively related to the mean of the distribution, implying a lower risk for higher mean performance outcomes (Miller and Reuer 1996).

Following the same procedure, I obtain an alternative measure of business risk based on the customer base structure, which measures the performance based on the proportion of goods sold to individual households, tourists, non-commercial government authorities, domestic non-state enterprises, state enterprises, foreign invested companies or to export. Additional measures of business risk used in the estimation are informal payments and temporary business closure.

The variable of interest, C_{it}, takes value 1 if a firm owns any internationally recognized certification and 0 otherwise. X_{it} are time-varying firm-specific and owner/manager control variables, such as firm size, ratio of capital to labour, export behaviour, gender of the owner or manager, and education level of the owner or manager. Firm size category is determined from the total number of regular full-time employees. It is a necessary control as larger firms have an advantage in complying with standards. A positive size effect on the adoption of standards was found in previous studies (Herath et al. 2007; Masakure et al. 2011; Nakamura et al. 2001). One explanation could be that fixed costs that are bound to be incurred in relation to implementation of standards are less significant for larger firms. Ratio of capital and labour is also included in the estimation to proxy for the cost and the nature of technology. This is measured as the deflated value of the total assets of the firm divided by the total number of full-time employees. Firms in contact with foreign markets are more likely to obtain certifications, so the estimation controls for exporting. Managerial characteristics are important for firm performance (Bloom and Van Reenen 2007), so the estimation controls for gender and education level of the owner or manger. Due to relatively high levels of completion of primary and secondary school in Viet Nam, the control variable for education is a dummy variable taking value one if the owner or manager have completed any post-secondary education, which captures a potential premium for higher education. The estimation also controls for industry, province and legal ownership form to account for common factors affecting all firms within industries, provinces and particular legal ownership forms. All monetary variables are corrected for spatial cost of living between different provinces.

The key variable for certification is potentially endogenous, as there could be unobserved firm characteristics that influence the firm's certification decision that are also correlated with risk performance. For example, a manager of a firm may have access to specific information or experience, which could both lead to the adoption of standards and better risk performance. Including firm-fixed effects addresses this issue to some extent, given that it allows controlling

directly for all time-invariant unobserved firm-specific factors, such as manager preferences and characteristics that do not change over time. In addition, time dummies, τ_t, control for general trends that affect all firms, while location dummies control for policy changes that may differentially impact firm performance in different geographical areas.

The estimation could be biased by omitted time-varying unobservable factors that impact both business risk and certification decisions, such as, for example, a change in management. The bias due to time-varying unobservable factors could be both positive and negative. For example, a change in management could be such as to increase business risk and reduce investment in certification, in which case the least squares effect size will be overestimated. It may also be that a new management is more favourable of certification due to a change in regulations or buyers' preferences, which could reduce business risk and lead to underestimated least squares effect size. These examples illustrate that the direction of causality may be difficult to disentangle, so the results are correlations without assigning a causal interpretation.

5   Results

To see which firms decide to certify against international standards, the adoption of standards is estimated as a function of observable firm characteristics, such as size, asset ownership, production of final goods, ownership type and location, as described in the previous section. The results using pooled least squares and fixed-effect estimations on the unbalanced and balanced panel, respectively, are shown in Table 3. All least squares and probit specifications control for firm location, technology type of the sector in which it operates, legal ownership form, and survey year. Time-invariant sector and location controls, as well as the owner's gender are excluded from the fixed-effect model in column (6).

Table 3 shows the determinants of certification. We see from column (1) that firm size is a strong predictor of the adoption of standards. The subsequent columns show that other firm characteristics also contribute to the decision to adopt standards, confirmed by a decrease of the firm size coefficient. Enterprises that are endowed with more capital are, as expected, more likely to adopt standards. Exporting firms are also more likely to decide in favour of certification. The relationship is positive and significant across all specifications.

Table 3. Determinants of international standard certification

Dep. var. Certification	OLS (1)	OLS (2)	OLS, balanced (3)	Probit marginal effects (4)	Probit, balanced (5)	FE, balanced (6)
Firm size (ln)	0.092***	0.059***	0.068***	0.044***	0.049***	0.079***
	(0.004)	(0.005)	(0.006)	(0.003)	(0.004)	(0.006)
Capital/Labour (ln)		0.016***	0.021***	0.019***	0.021***	0.024***
		(0.003)	(0.004)	(0.003)	(0.003)	(0.004)
Export		0.011*	0.010	0.010*	0.010	
		(0.007)	(0.008)	(0.006)	(0.007)	
Post-secondary education		0.000	0.000	0.000	0.000	0.000***
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female owner or manager		0.241***	0.253***	0.078***	0.086***	0.229***
		(0.023)	(0.026)	(0.007)	(0.009)	(0.030)
Constant	-0.120***	-0.273***	-0.342***			-0.426***
	(0.009)	(0.043)	(0.053)			(0.053)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	No	Yes	Yes	Yes	Yes	No
Legal FE	No	Yes	Yes	Yes	Yes	No
Location FE	No	Yes	Yes	Yes	Yes	No
R^2	0.16	0.24	0.26			
Observations	5,803	5,792	4,448	5,792	4,448	4, 448

Note: OLS stands for ordinary least squares. Robust standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Source: Author's calculation based on the SME data.

Table 4 shows the relationship between certification and business risk. Columns (1)–(4) show least square estimation results. The first three columns show the results for the unbalanced and column (4) shows the results for the balanced panel. The final column shows the results with firm–fixed effects, which, as described in the previous section, account for bias due to time-invariant unobservable heterogeneity.

All specifications show a negative association between certification and business risk. A decision to certify an internationally recognized standard for managing the quality, safety, or environmental impact of the production, associates with a 5.6 per cent lower business risk. Fixed-effects estimates are slightly higher than the least squares estimates, indicating that the unobserved heterogeneity correlates negatively with certification incidence. This suggests that less productive firms are more likely to self-select into certification of international standards and that fixed-effects correct for the downward bias in least square estimation.

Control variables—such as firm size and having a female owner or manager—also correlate negatively with business risk. Assets also show a negative association with business risk and exporting shows a positive association, but the relationship is imprecisely determined in all specifications.

Table 4. The relationship between certification and business risk

Dep. var. Business risk	OLS (1)	OLS (2)	OLS (3)	OLS, balanced (4)	FE, balanced (5)
Certification	-0.113***	-0.033*	-0.035*	-0.047**	-0.057**
	(0.018)	(0.020)	(0.020)	(0.021)	(0.028)
Firm size (ln)		-0.048***	-0.049***	-0.046***	-0.068***
		(0.005)	(0.006)	(0.007)	(0.015)
Capital/Labour (ln)		-0.006	-0.002	0.002	-0.005
		(0.004)	(0.004)	(0.005)	(0.008)
Export		0.016	0.018	0.016	-0.005
		(0.020)	(0.020)	(0.022)	(0.046)
Post-secondary education		-0.000***	-0.000	-0.000	0.000
		(0.000)	(0.000)	(0.000)	(0.000)
Female owner or manager		0.006	-0.019**	-0.019*	
		(0.009)	(0.009)	(0.011)	
Constant	1.112***	1.314***	1.320***	1.255***	1.292***
	(0.008)	(0.051)	(0.058)	(0.069)	(0.121)
Year dummies	Yes	Yes	Yes	Yes	Yes
Sector FE	No	No	Yes	Yes	No
Legal FE	No	No	Yes	Yes	No
Location FE	No	No	Yes	Yes	No
R^2	0.01	0.04	0.12	0.11	0.02
Observations	5,723	5,723	5,723	4,419	4,419
Number of firms	2,969	2,969	2,969	1,671	1,671

Note: OLS stands for ordinary least squares. Columns (1)–(3) show results from unbalanced panel. Robust standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$

Source: Author's calculation based on the SME data.

Table 5 shows the relationship between certification and additional measures of business risk, such as customer risk, temporary closure and informal payments. The results show again a negative association between certification and different risk measures.

How does the effect of certification on business risk come about? It is likely that simultaneously different mechanisms are in force that may influence several dimensions of firm performance. The implementation of standards entails incentives for adjusting the production systems towards planning and performance analysis, which could stabilize the revenue streams over time. Standards are also credited with improved working conditions and workplace practices (Levine and Toffel 2010; Trifković 2017), leading to better employee performance, which could lead to more stable revenue streams by reducing the number of instances of product malfunctioning, damage or contamination. Finally, standards inform customers about higher product reliability, which could result in more stable levels of purchase.

Table 5. The relationship between certification and business risk: Additional risk measures

Dep. var.:	Customer risk		Informal payments		Temporary closure	
	OLS	FE, balanced	OLS	FE, balanced	OLS	FE, balanced
	(1)	(2)	(3)	(4)	(5)	(6)
Certification	-0.091***	-0.103**	-0.088***	-0.123***	-0.017	-0.041*
	(0.025)	(0.042)	(0.027)	(0.045)	(0.015)	(0.023)
Firm size (ln)	-0.069***	-0.080***	0.067***	0.002	-0.020***	-0.081***
	(0.008)	(0.022)	(0.008)	(0.025)	(0.005)	(0.018)
Capital/Labour (ln)	-0.030***	-0.020	0.037***	0.040***	0.008*	-0.008
	(0.006)	(0.013)	(0.006)	(0.015)	(0.004)	(0.010)
Export	0.047*	-0.097*	0.034	0.055	0.036**	0.016
	(0.025)	(0.052)	(0.027)	(0.064)	(0.017)	(0.031)
Post-secondary education	-0.000	-0.000	-0.000	-0.001	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female owner or manager	-0.017		-0.002		-0.023**	
	(0.012)		(0.013)		(0.009)	
Constant	1.941***	1.797***	-0.069	0.077	0.069	0.433***
	(0.079)	(0.191)	(0.082)	(0.215)	(0.056)	(0.144)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	No	Yes	No	Yes	No
Legal FE	Yes	No	Yes	No	Yes	No
Location FE	Yes	No	Yes	No	Yes	No
R^2	0.12	0.01	0.10	0.01	0.04	0.02
Observations	5,792	4,448	5,792	4,448	5,792	4,448
Number of firms	2,986	1,671	2,986	1,671	2,986	1,671

Note: OLS stands for ordinary least squares. Robust standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Source: Author's calculation based on the SME data.

5.1 Heterogeneity analysis

The distributional differences in the relationship between certification and business risk are assessed in a more systematic way by focusing on different deciles of the risk distribution. The specification of the quantile regressions is exactly the same as the least squares regression in column (3) in Table 4. Least squares and quantile regressions coefficients are given in Figure 3, where the red line presents quantile regression coefficients and the black line shows the least squares coefficients. The dashed part of the least squares line indicates the part of distribution in which least squares and quantile regression coefficients are statistically different, while the full line indicates the area where the coefficients from two types of estimations are not statistically different from each other.

The results in Figure 3 show statistically significant and negative association of certification and business risk in 30 to 50 per cent deciles. The point estimates are highest around the median (-0.14). The relationship between certification and risk is not statistically significant in the bottom and the top deciles of the risk distribution. This indicates that the gain from standards is a decline in business risk of about 15 per cent for the middle risk levels. This finding indicates that larger levels of business risk could require other means of risk management than standards.

Figure 3. Least square and quantile regression coefficients
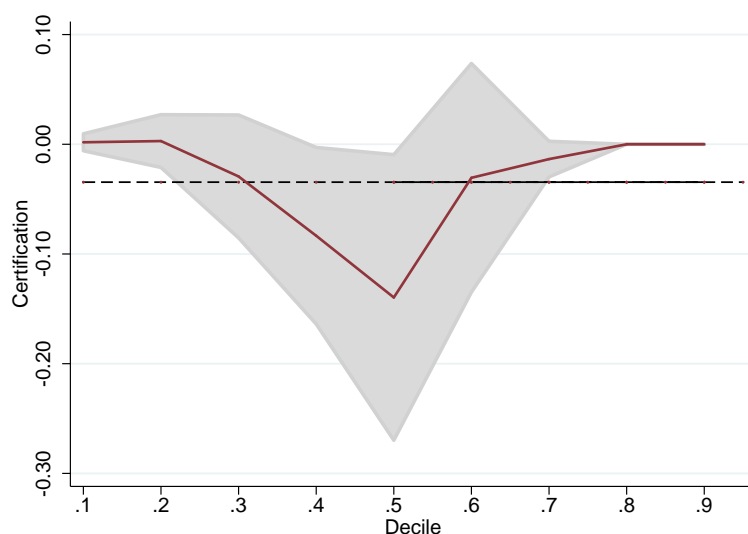
Notes: The red line presents quantile regression coefficients and the black line shows the least squares coefficients. The dashed part of the least squares line indicates the part of distribution in which least squares and quantile regression coefficients are statistically different, while the full line indicates the area where the coefficients from two types of estimations are not statistically different from each other.

Source: Author's illustration based on the SME data.

In Table 6, location controls are excluded to investigate if location differences, such as urban-rural and south-north, are associated with different benefits of certification. The south-north differences are particularly relevant due to country's historical division into south and north regions, which nowadays manifests in different modes of operation, behaviour and managerial styles (Ralston et al. 1999). The estimates in column (1) show a negative association between certification and business risk for enterprises located in rural areas. As shown in column (2), the relationship is also significant and negative among the firms in the north, perhaps a consequence of higher competitive pressures.

The market in which main products are sold can affect certification decisions (Adolph et al. 2017; Newman et al. 2017), so column (3) shows the result for firms from the sample who export at least some part of their output. The estimates show a negative correlation between certification and risk for exporting firms, but the effect is not precisely determined. Similarly, there are no heterogeneous effects by firm owner's gender. Column (5) shows a significantly negative correlation between certification and risk for firms that operate in technologically more advanced industries.

More innovative firms, that is, those that tend to invest in innovative activities, such as introducing new or modifying existing products or technologies, are found to be more likely to adopt standards (Calza et al. 2017; Manders et al. 2016). This relationship is not simple, as standards and innovation can have synergistic benefits, but may also compete for resources, which is why the interplay depends on the importance of signalling in the business model of the firm, firm motivation, the sector and the region in which the firm operates. The results in column (6) show a significantly negative correlation between certification and risk for firms that do not implement product improvements, indicating opposite influence of standards and innovation on business risk.

Table 6. Certification and business risk for different sub-samples

Dep. var. Business risk	Rural	North	Export	Female owner	Medium to high technology	No innovation
	(1)	(2)	(3)	(4)	(5)	(6)
Certification	-0.074**	-0.074***	-0.011	-0.008	-0.072***	-0.059**
	(0.030)	(0.028)	(0.053)	(0.028)	(0.025)	(0.026)
Firm size (ln)	-0.051***	-0.051***	-0.019	-0.060***	-0.029***	-0.049***
	(0.009)	(0.009)	(0.028)	(0.010)	(0.009)	(0.008)
Capital/Labour (ln)	-0.002	0.002	-0.045**	-0.010	0.008	-0.005
	(0.006)	(0.006)	(0.021)	(0.007)	(0.006)	(0.005)
Export	-0.023	-0.019	-0.059		-0.008	0.013
	(0.015)	(0.015)	(0.048)		(0.015)	(0.012)
Post-secondary education	-0.000***	-0.000	-0.001	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Female owner or manager	0.012	0.005		0.037	-0.004	0.033
	(0.032)	(0.033)		(0.033)	(0.029)	(0.027)
Constant	1.379***	1.355***	1.930***	1.404***	1.022***	1.303***
	(0.081)	(0.081)	(0.339)	(0.101)	(0.086)	(0.072)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	No	No
Legal FE	Yes	Yes	Yes	Yes	Yes	Yes
Location FE	No	No	Yes	Yes	Yes	Yes
R^2	0.11	0.13	0.21	0.13	0.05	0.06
Observations	3,070	2,797	265	2,325	3,467	4,336

Note: OLS (ordinary least squares) regressions on unbalanced panel. Robust standard errors in parentheses. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Source: Author's calculation based on the SME data.

6   Conclusion

This paper has examined the relationship between certification of international standards and business risk on a sample of manufacturing firms from Viet Nam. The results show that certification contributes to a significant reduction in business risk, measured as fluctuation of revenue of firm's three most important products over time. The result is in particular relevant for the middle deciles of the risk distribution. Heterogeneity analysis by location shows risk-reducing benefits of standards for firms located in rural areas and northern provinces, as well as for firms that use technologically advanced production methods. Certification also tends to assure a more stable customer portfolio, reduce informal payments, and prevent temporary business closure.

The results suggest that certification of internationally recognized standards is a strategic decision for firms, illustrating benefits from investing in activities that go beyond minimal regulatory compliance. Policy support for certification could take the form of tax deductions for one part of the implementation expenditures and information campaigns on how to deduct some of the associated costs. This could encourage further adoption of international standards by SMEs from Viet Nam, providing a way of sheltering from business downsides.

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