



The Causal Impacts of International Standard Certifications on Firm Performance: Evidence from Malaysia

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ABSTRACT

The objective of this study is to examine the causal effects of international standards certification (ISC) on the performance of Malaysian firms, while accounting for potential endogeneity between ISC and firms' performance. Previous studies have rarely accounted for endogeneity between ISC and firms' performance, which may bias estimates and lead to incorrect conclusions about their causal relationship. This study uses data from the World Bank Enterprise Survey (WBES), 2019-20. The estimation methods account for the endogeneity between ISC and firms' performance by combining instrumental variables with treatment-effect modelling. Three performance measures are used: sales and gross profit per employee, and the cost of goods sold scaled by sales. The analyses, both univariate and multivariate, demonstrate that ISC improves the performance of Malaysian firms, especially manufacturing firms; however, the finding is not supported for firms in the service sector. Foreign ownership also improves firms' performance. In terms of endogeneity, the cost of goods sold and performance are endogenously related, whereas sales and gross profit per employee are not.

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1. INTRODUCTION

International Standards Certification (ISC) constitutes formal verification by an accredited body that a firm, product, or service complies with established international standards. Firms adopting ISC typically experience significant benefits from implementing standardised practices that enhance operational efficiency and productivity. These certifications, developed by standards-setting bodies such as the International Telecommunication Union (ITU) and the International Organisation for Standardisation (ISO), serve to ensure quality, safety, efficiency, and interoperability across industries and national boundaries (Bai, 2021; Vinodkumar & Bhasi, 2011; Matias & Coelho, 2002).

While ISC demands substantial financial and operational investments, it also yields important organisational benefits including identifying operational inefficiencies, streamlining business processes, and ultimately improving profitability. In addition to these, internal advantages, ISC functions as a credible quality signal to external stakeholders, thereby

enhancing corporate reputation. Furthermore, certification is often required to secure government contracts and access international markets, underscoring its strategic value (Blind et al., 2020). However, at the same time, it is expected that more efficient firms are more likely to obtain an ISC and to anticipate performance gains from ISC (Goedhuys & Sleuwaegen, 2013; Potoski & Prakash, 2005).

The global standards ecosystem operates through an interdependent framework comprising three key entities: i. standard-setting bodies, ii. certification bodies, and iii. accreditation bodies. Standard-setting bodies (such as ISO and ITU) develop and publish international standards through consensus-based processes involving industry experts, thereby establishing universal benchmarks for best practices. Independent certification bodies assess firms' or organisations' compliance with these standards through rigorous audits and evaluations, issuing formal certifications upon successful verification. To maintain the integrity of this system, accreditation bodies supervise certification bodies, ensuring their technical competence and impartiality through

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comprehensive evaluations against strict international criteria (Dankers & Liu, 2003). This multi-tiered governance structure establishes a robust quality-assurance mechanism that promotes uniformity and reliability across industries worldwide.

ISC addresses diverse organisational aspects, from quality and environmental management to working conditions and social responsibility (Hemphill, 2013). Despite varied applications, most ISC systems share fundamental operational similarities in their implementation frameworks. The ISO management system standards, for instance, have progressively incorporated social dimensions, demonstrating their adaptability to evolving global challenges (Denton & Maatgi, 2016).

The Standards of Malaysia Act 1996 (Act 549) governs standardisation in Malaysia. It establishes the legal framework for Malaysia's national quality infrastructure (NQI) and its relationship to standards. The Department of Standards Malaysia (JSM), operating under the Ministry of Investment, Trade, and Industry (MITI), is mandated to serve as the National Standards Body (NSB) and National Accreditation Body (NAB). This dual role enables JSM to oversee the development, adoption, and accreditation of standards to ensure Malaysia's compliance with global standards and enhance its competitiveness in international markets. Standards influence all sectors of Malaysian society by setting benchmarks for quality, safety, environmental protection, and competitiveness.

The Malaysian Standard (MS) represents the foundation of Malaysia's standardisation efforts. It is developed and published through collaborations between JSM, SIRIM Berhad, Conformity Assessment Bodies (CABs), and various advisory committees. MS are designed to meet industry-specific needs while maintaining alignment with international benchmarks. Malaysia's standardisation system relies on a consensus-based process that involves input from manufacturers, traders, consumers, government agencies, and other stakeholders. This inclusive approach ensures that the standards developed are practical, relevant, and reflective of the country's socio-economic needs (Harmes-Liedtke, 2022).

The Malaysian Standardisation Framework is essential for fostering economic growth and enhancing Malaysia's global competitiveness. Malaysia has a strong focus on integrating international standards into its national framework. Adoption and localisation of ISO standards into MS/ISO standards ensures alignment with global benchmarks. This enables Malaysian firms to gain international recognition while meeting local regulatory requirements. The use of international standards fosters trust in Malaysian products and services and facilitates access to global markets. MS's alignment with international standards helps build a strong accreditation system that makes sure Malaysia's goods and services meet the needs of people around the world.

This study investigates the causal effects of ISC on firms' performance in Malaysia, accounting for potential endogeneity between ISC and firms' performance. It asks whether ISC improves the performance of Malaysian firms, after controlling for potential endogeneity between certification adoption and firm performance. Previous studies have rarely accounted for endogeneity between ISC and firms' performance, which may bias estimates and lead to incorrect conclusions about their causal relationship. The data used is from the World Bank Enterprise Survey, 2019–2020 (WBES). The results show that

ISC positively affects firms' performance, particularly for manufacturing firms, and that firms with ISC outperform those without; however, this positive finding is not supported for firms in the service sector. Standardisation can be categorised into *de jure* and *de facto*. *De facto* standardisation emerges from competition among different firms or coalitions, often involving a standardisation struggle or even a "standards war" (Techatassanasoontorn & Suo, 2011). This study focuses on *de jure* standardisation, which independent firms establish and sometimes enforce through legislative mandates.

2. ISC AND FIRMS' PERFORMANCE

The majority of studies on the effects of ISC on firm productivity or performance have reported positive relationships (Wu & de Vries, 2022; Alsyouf, 2021; Wakke et al., 2016; Boiral, 2012). However, the benefits gained from ISC have also been questioned (Rillo & Jakobs, 2023; Gomez & Rodriguez, 2011; Barla, 2007; Dick, 2000). The differences in results can be linked to variations in the data samples, the diverse business environments in which the firms operate, and the standards examined.

Despite extensive literature documenting positive associations between ISC and firm performance, it does not adequately address potential endogeneity arising from self-selection. It is expected that more productive firms are more likely to adopt certification, which complicates causal interpretation. As a result, estimated performance gains may be overstated, particularly in studies that rely on cross-sectional data and conventional regression techniques.

In general, internal and external improvements may explain the positive impact of ISC on firms' performance. The internal and external improvements highlight the multifaceted impacts of standards, showing how they can drive improvements both within firms and across broader industry landscapes. Internal improvement focuses on the direct, micro-level benefits within a firm, such as operational efficiency and quality control. External improvement focuses on macro-level impacts on industry and society, including market expansion, interoperability, and consumer confidence (Sharma, 2005). By combining internal and external factors, Hansen and Wernerfelt (1989) provide a more comprehensive picture of a firm's performance by linking economic and organisational theories. They stress the importance of both external market conditions and internal firm strengths for a firm to do well.

The internal improvement view indicates that ISC enhances firms' performance by fostering greater quality awareness (Tari et al., 2019; Lakhal, 2014; Quazi et al., 2002; Gilbert & Sia, 2001; Rao et al., 1997), while requiring firms to follow best practices that reduce production risks, optimise internal processes, increase productivity and efficiency, and ensure quality (Gallego & Gutiérrez Ramrez, 2023; Blind & Muller, 2020; Ruales Guzmán et al., 2019; Wiengarten et al., 2017; Anderson, Daly & Johnson, 1999; Tzelepis et al., 2006). ISC provides a competitive edge by having employees who recognise the significance of providing high-quality output carry out their activities with that goal in mind. Because a firm with ISC is committed to maintaining a high-quality workplace, employees will encounter fewer on-the-job problems, increasing their motivation and job satisfaction, which will improve their productivity (Boys & Wilcock, 2014). Employees are more productive and efficient when they are

aware of quality objectives and share a common strategic vision (Marquardt, 1992). Enhancing productivity and efficiency through certification enables ISC to reduce costs by minimising non-value-added activities, reducing waste, and reducing warranty claims. ISC also provides training guidelines that ensure that a company's employees adhere to the same practices and operate consistently. Furthermore, ISC also reduces transaction costs associated with operations, minimises uncertainties, and addresses inefficiencies in interactions with suppliers, customers, and stakeholders (Goedhuys & Sleuwaegen, 2016).

Externally, the pursuit of ISC indicates a firm's strategic intent to focus on quality; the primary drivers are customer expectations and contractual requirements (Milovanović, 2023; Sampaio et al., 2009; Terlaak & King, 2006; Yahya, 2003). ISC that indicates quality increases brand credibility and improves the selection process of suppliers (Yamada, 2001; Dale, 1994). Therefore, firms with ISC are better at broadening their client base and hence their market position (Yang et al., 2023; Siltori et al., 2020), thereby increasing sales. ISC allows firms to conform to industry norms and gain legitimacy, driven by external pressures such as regulatory requirements, customer demands, and industry expectations (Bansal & Bogner, 2002). Furthermore, according to signalling theory, the adoption of ISC communicates firms' commitments to quality and sustainability to external stakeholders, thereby building trust and enhancing reputation (Ullah, 2020). Standardisation also enables firms to achieve interoperability, benefit from positive network effects, and address informational asymmetries (Rietveld & Schilling, 2021).

However, these mechanisms implicitly assume effective implementation and internalisation of standards, an assumption that may not hold uniformly across firms. In practice, certification may be adopted symbolically rather than substantively, leading to heterogeneous performance outcomes that are not always captured in empirical studies.

The potential to generate substantial economic value often justifies the voluntary adoption of ISC, even though it may incur substantial costs. Certification costs encompass implementation costs, including organisational restructuring and training, as well as the expenditure required to create and update necessary standard operating procedures. Furthermore, certification expenses also include third-party certification audit fees (Potoski & Prakash, 2009). Certification audit costs, in addition to the costs of implementing and maintaining the management system, are substantial and depend on the firm's size and preparedness (Anderson et al., 1999). Firms will only invest in certification if they are convinced that the gains are substantial.

These costs may disproportionately constrain smaller firms and service-sector enterprises, potentially limit the net performance benefits of certification and contribute to sectoral differences observed in empirical findings.

While studies on standards in the Malaysian context are limited and have focused on specific standards, they have also shown a positive relationship between the ISC and firms' performance. For instance, Nga (2009) demonstrates that ISO 14000-certified firms exhibit a superior average return on equity, although this does not necessarily correlate with sales and capitalisation. Otsuki et al. (2014) show that compliance with the EU Restriction of Hazardous Substances (RoHS) and

the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) significantly increases the probability of export and market penetration into more countries. Ann et al. (2006) demonstrate that ISO 14001 certification positively influences firms' performance, particularly with respect to perceived economic and environmental impacts and customer satisfaction. Din et al. (2011) show that the performance of ISO 9000-certified firms in their project environments is better than that of non-certified firms, and Zakuan et al. (2009) show that ISO/TS 16949 indirectly influences the association between firms' performance and TQM implementation.

These Malaysian studies provide valuable insights, but they focus on specific standards and rely on descriptive or association-based analyses, with limited attention to endogeneity and causal inference. Consequently, evidence on the causal impact of ISC across sectors and performance dimensions in Malaysia remains limited.

3. EMPIRICAL MODEL

This study is based on the Resource-Based View (RBV) of the firm. It posits that differences in firms' performance arise from heterogeneity in valuable, rare, inimitable, and non-substitutable resources and capabilities. It is expected that ISC provides organisations with the capability that codifies best practices, strengthens internal routines, and enhances managerial control that improves firms' efficiency and competitiveness. Under RBV, firm performance is a reduced-form outcome of certification status and observable firm-specific resources and capabilities. Because firms with stronger capabilities are more likely to self-select into ISC adoption, certification, and performance may be jointly determined, providing a theoretical justification for addressing endogeneity in the empirical analysis.

The empirical model to assess the impact of ISC on firms' performance is based on Goedhuys & Sleuwaegen (2016), Ullah et al. (2014), and Lafuente et al. (2010). The empirical model is:

$$Prod_i = \beta_0 + \beta_1 ISC_i + \beta_2 Age_i + \beta_3 Size_i + \beta_4 Exp_i + \beta_5 For_i + \epsilon_i \quad (1)$$

Where *Prod* is performance measures, *ISC* is a dummy variable indicating whether a firm has ISC, *Age* is the age of the firm, *Size* is the size of the firm, *Exp* is the share of exports in the firm's sales, and *For* is the firm's share of foreign ownership.

To ensure the robustness of the results, three performance measures are used to examine the effects of ISC on firms' performance: two measures of labour performance and a measure of the cost of goods sold (*COGS*). The labour performance measures are the natural log of sales per employee (*Prod1*) and the natural log of gross profit per employee (*Prod2*); the cost of goods sold is scaled by sales. The three performance measures are:

$$Prod1 \equiv \ln(sales_{t-1}/employees_{t-1}) \quad (2)$$

$$Prod2 \equiv \ln((sales_{t-1} - \text{cost of goods sold}_{t-1}) / employees_{t-1}) \quad (3)$$

$$COGS \equiv \text{cost of goods sold}_{t-1} / sales_{t-1} \quad (4)$$

3.1 Control Variables

The control variables are the age and size of the firm, the share of exports in the firm's sales, and the share of the firm owned by foreigners, which is in line with other studies on firms' performance (Mulugeta & Soderbom, 2024; Edeh et al., 2024; Ullah et al., 2014; Lafuente et al., 2010).

A principal challenge for a new firm is establishing positive, reliable relationships with its stakeholders and developing systems and processes that function effectively in the market. A firm can build and maintain reliable connections with its clients, creditors, and suppliers over time by fulfilling their expectations (Du et al., 2021). A firm's ability to accumulate information increases with age due to accumulated experience, and an established firm can more easily attain organisational learning (Santoro et al., 2021; Hael et al., 2024). However, as a firm matures, it may struggle to adapt to shifting environments. The decline in flexibility and adaptability may result in the loss of market position to younger, more innovative firms that can more effectively adjust to evolving market conditions (Leyva-De la Hiz & Bolívar-Ramos, 2022).

In perfectly competitive markets, profit rate is expected to be similar across firms. However, in imperfectly competitive markets, firm size plays a crucial role in determining profit rate, because economies of scale and other technical and economic efficiencies are related to the size of the firm (Baumol, 1959). Furthermore, larger firms can expand investment that can increase earnings per investment, a capacity that smaller firms often cannot achieve due to financial constraints. Large firms also possess a competitive advantage over smaller enterprises, as they can diversify into multiple product lines, thereby leveraging economies of scale. Consequently, larger firms may generally achieve profits that are at least as high as those of smaller firms. Diseconomies of scale and complexity, however, can also indicate the influence of size. As firms expand, coordination costs, bureaucratic inefficiencies, and agency problems will increase. Above a certain threshold, expansion may result in inefficiency (Muthusamy & Kannan, 2023).

Melitz (2003) expects firms with productivity levels exceeding the export threshold to penetrate overseas markets. Indeed, substantial empirical evidence indicates that firms involved in exports are more productive than those operating solely in domestic markets (Segarra-Blasco, 2022; Bernard et al., 2012). The capacity to export suggests that firms with better productivity self-select into exporting, as their productivity advantage enables them to offset the increased costs associated with serving overseas markets. The learning-by-exporting theory also posits that firms become more productive through export-related activities. The productivity-enhancing impact of a firm's global operations stems from heightened competitiveness arising from expanded global markets and the knowledge and skills associated with overseas markets, which non-exporters lack. These indicate an expected positive

relationship between exporting and firms' performance (Freixanet & Federo, 2023; Liang et al., 2024).

Firms with foreign ownership have greater access to the global markets and technologies. This is expected to result in improved performance relative to solely domestic enterprises. Foreign investors also contribute additional capital and enhance local labour skills (Xu et al., 2022; Lindemanis et al., 2022). Indeed, governments have increasingly liberalised their regulations to attract foreign investment, recognising its positive impact on domestic enterprises and economic growth. Jusoh (2015) demonstrates that foreign ownership enhances firm performance and efficiency in Malaysia. Foreign owners contribute not only capital but also technological and management expertise.

3.2 Data

This study utilises data from the WBES on Malaysia, collected during 2019-2020. The total number of firms surveyed was 1221, of which 441 were small, 445 were medium, and 335 were large. WBES employs stratified random sampling with replacement. The stratification criteria for the WBES include firm size, industry sector, and geographical region (World Bank, 2020). While the WBES provides comprehensive and internationally comparable firm-level data, it is subject to limitations, including reliance on self-reported information, potential recall and reporting biases, which may affect the precision of estimated relationships.

In calculating the measures of performance in equations 2 through 4, the data for $sales_{t-1}$ is from WBES item d2, and $employees_{t-1}$ from WBES item l1. The cost of goods sold comprises the total annual costs of labour, raw materials, and intermediate goods used in production, derived from WBES data items n2a and n2e, respectively. *ISC*, the primary variable of interest, is a dummy variable that indicates whether a firm has an ISC (item b8 in the WBES). *ISC* equals 1 if the firm has an ISC and 0 if it does not. For the control variables, *Age* is calculated as the survey year minus the firm's founding year (WBES item b5). *Size* is measured by the number of employees, as captured by WBES item l1. *Exp* is the share of exports in a firm's sales, as defined in WBES item d3c. *For* is the firm's foreign ownership share which is item b2b of WBES.

3.3 Endogeneity between Firms' Performance and ISC

More efficient firms are expected to be more likely to obtain an ISC and to realise performance gains from it (Goedhuys & Sleuwaegen, 2013). Thus, in the estimation process, this study accounts for the potential endogeneity of ISC in the performance equations. To address potential endogeneity between ISC adoption and firms' performance, this study combines instrumental variables (IV) with treatment effects modelling (Cerulli, 2014; Wooldridge, 2002). This approach corrects for self-selection bias by using instruments as exogenous sources of variation.

The probability of a firm obtaining ISC is estimated using all variables in the performance equation, including two additional instrumental variables: *KPI* and *Tech*. *KPI* measures whether the firm has established production or service targets, which corresponds to WBES item r4. At the same time, *Tech* evaluates whether the firm utilises a license from a foreign firm, corresponding to item e6 of WBES. These instruments are employed because licensors frequently mandate companies utilising foreign licenses to implement ISC, and firms with

KPIs typically possess ISC, as KPIs are vital for assessing and overseeing performance, which is essential for demonstrating compliance with ISC and attaining quality objectives (Alsyouf et al., 2021).

Two approaches are used to test for endogeneity: the Durbin-Wu-Hausman endogeneity test (and control function method that addresses endogeneity in simultaneous equation systems, particularly with binary/dummy endogenous variables (Heckman, 1978; Wooldridge, 2015).

4. RESULTS

Tables 1 and 2 summarise the data. Table 1 compares the characteristics of firms with and without *ISC*. The last column reports *t*-statistics indicating whether the means of the two groups of firms differ. The share of firms with *ISC* is 36% (418 firms), which is relatively high compared with other developing countries (Goedhuys & Sleuwaegen, 2016). The mean share of exports in sales for firms with *ISC* is 35%, while it is only 7% for firms without *ISC*. Firms with *ISC* are older than those without; the mean age of firms with *ISC* is approximately 4 years higher than that of firms without. The mean firm size with *ISC* is approximately 256 employees, whereas for firms without *ISC*, it is approximately 52 employees. The foreign ownership share of firms with *ISC* is also higher, at 26.9%, compared with 4.7% for firms without *ISC*. Firms with *ISC* outperform those without, as evidenced by the statistically significant differences in the means for *Prod1* and *Prod2*. As for *COGS*, the mean for firms with *ISC* is lower, indicating that it is better than that for firms without *ISC*. Regarding the use of instrumental variables, 87% of firms with *ISC* have a *KPI*, compared with 56% of firms without *ISC*. For *Tech*, which measures whether the firm uses licences from foreign firms, 26% of firms with *ISC* use foreign technology compared to 8% of firms without *ISC*. Table 2 reports the correlation between the variables. *KPI* and *Tech* are correlated with *ISC*; relative to their correlation with *ISC*, their

correlations with firms' performance are small; thus, they are suitable instruments for *ISC*.

Table 1. Summary Statistics for *ISC* and non-*ISC* Firms

Var	ISC		Non-ISC		t-stat mean diff
	Obs	Mean	Obs	Mean	
<i>ISC</i>	418		759		
<i>Exp</i>	411	34.99	741	7.07	-15.54
<i>Age</i>	416	24.711	753	20.07	-5.96
<i>Size</i>	418	256.14	758	52.36	-8.87
<i>For</i>	406	26.96	743	4.72	-12.17
<i>Prod1</i>	404	12.282	735	11.66	-8.25
<i>Prod2</i>	315	11.86	295	11.43	-5.09
<i>COGS</i>	315	0.589	295	0.652	2.79
<i>KPI</i>	416	0.87	747	0.56	-11.53
<i>Tech</i>	400	0.26	748	0.08	-8.84

Table 3 reports the results of the first stage of the 2SLS, which is the Probit estimation explaining the probability that a firm has an *ISC*. In addition to *KPI* and *Tech*, all control variables used in the second-stage model of firms' performance are included in the first-stage Probit regression. The first three columns of Table 3 present results using all observations, and the last three columns present results for manufacturing firms. The columns *Prod1*, *Prod2*, and *COGS* denote the corresponding dependent variables in the second-stage regressions. The results of the first-stage Probit regression are consistent with expectations: the coefficients are positive for *Size*, *Age*, *Exp*, *For*, and the *KPI* and *Tech* instruments. The results are also similar for manufacturing firms.

Table 2. Correlation Matrix

	ISC	Age	Size	Exp	For	Prod1	Prod2	COGS	KPI	Tech
<i>ISC</i>	1									
<i>Age</i>	0.17	1								
<i>Size</i>	0.25	0.14	1							
<i>Exp</i>	0.42	0.12	0.25	1						
<i>For</i>	0.34	0.08	0.20	0.51	1					
<i>Prod1</i>	0.24	0.10	0.06	0.17	0.18	1				
<i>Prod2</i>	0.20	-0.01	0.06	0.06	0.15	0.82	1			
<i>COGS</i>	-0.11	0.05	-0.04	-0.03	-0.15	-0.39	-0.63	1		
<i>KPI</i>	0.33	0.02	0.12	0.11	0.15	0.09	0.10	-0.12	1	
<i>Tech</i>	0.25	-0.00	0.18	0.15	0.17	0.06	0.12	-0.10	0.15	1

Table 3. Results of the Probit equation, explaining the probability that the firm has an ISC

	All			Manufacturing		
	<i>Prod1</i>	<i>Prod2</i>	<i>COGS</i>	<i>Prod1</i>	<i>Prod2</i>	<i>COGS</i>
<i>KPI</i>	0.930 ^c (0.108)	1.014 ^c (0.136)	1.014 ^c (0.136)	1.001 ^c (0.133)	1.007 ^c (0.137)	1.007 ^c (0.137)
<i>Tech</i>	0.602 ^c (0.126)	0.641 ^c (0.171)	0.641 ^c (0.171)	0.684 ^c (0.164)	0.626 ^c (0.172)	0.626 ^c (0.172)
<i>Age</i>	0.013 ^c (0.003)	0.010 ^b (0.005)	0.010 ^b (0.005)	0.011 ^c (0.004)	0.010 ^b (0.005)	0.010 ^b (0.005)
<i>Size</i>	0.001 ^c (0.000)	0.001 ^c (0.000)	0.001 ^c (0.000)	0.001 ^b (0.000)	0.001 ^c (0.000)	0.001 ^c (0.000)
<i>Exp</i>	0.012 ^c (0.002)	0.010 ^c (0.002)	0.010 ^c (0.002)	0.011 ^c (0.01)	0.010 ^c (0.002)	0.010 ^c (0.002)
<i>For</i>	0.006 ^c (0.002)	0.006 ^c (0.002)	0.006 ^c (0.002)	0.005 ^c (0.002)	0.006 ^c (0.002)	0.006 ^c (0.002)
<i>Int</i>	-1.817 ^c (0.127)	-1.456 ^c (0.171)	-1.456 ^c (0.171)	-1.537 ^c (0.166)	-1.422 ^c (0.171)	-1.422 ^c (0.171)
R ²	0.266	0.245	0.245	0.247	0.238	0.238
Obs	1074	575	575	628	564	564

Notes: ^a p < 0.1, ^b p < 0.05, ^c p < 0.01.

Standard error in parenthesis

Table 4. Firms' Performance and ISC (all firms)

	OLS			IV-2SLS		
	<i>Prod1</i>	<i>Prod2</i>	<i>COGS</i>	<i>Prod1</i>	<i>Prod2</i>	<i>COGS</i>
<i>ISC</i>	0.466 ^c (0.086)	0.395 ^c (0.094)	-0.052 ^b (0.025)	0.622 ^c (0.238)	0.766 ^c (0.244)	-0.226 ^c (0.069)
<i>Age</i>	0.005 ^b (0.003)	-0.003 (0.003)	0.001 (0.000)	0.004 (0.003)	-0.004 (0.004)	0.002 ^b (0.001)
<i>Size</i>	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
<i>Exp</i>	0.002 (0.001)	-0.002 (0.001)	0.001 (0.000)	0.002 (0.002)	-0.003 ^b (0.002)	0.001 ^c (0.000)
<i>For</i>	0.003 ^c (0.001)	0.003 ^c (0.001)	-0.001 ^c (0.000)	0.003 ^b (0.001)	0.002 ^a (0.001)	-0.001 ^a (0.000)
<i>Int</i>	11.544 ^c (0.074)	11.494 ^c (0.102)	0.627 ^c (0.027)	11.523 ^c (0.821)	11.395 ^c (0.121)	0.675 ^c (0.033)
R ²	0.069	0.044	0.024	0.060	0.008	
F	16.31	6.42	3.91	11.40	4.54	5.06
DWH				1.22	4.76	11.90
Prob				(0.943)	(0.312)	(0.018)
CFA				1.33	5.18	12.32
Prob				(0.249)	(0.023)	(0.000)
Obs	1100	594	594	1074	575	575

Notes: ^a p < 0.1, ^b p < 0.05, ^c p < 0.01.

Standard error in parenthesis

Durbin-Wu-Hausman (DWH) Test, (CFA)Control Function approach

Table 5. Firms' Performance and ISC (Manufacturing)

	OLS			IV-2SLS		
	<i>Prod1</i>	<i>Prod2</i>	<i>COGS</i>	<i>Prod1</i>	<i>Prod2</i>	<i>COGS</i>
<i>ISC</i>	0.548 ^c (0.103)	0.388 ^c (0.095)	-0.052 ^b (0.025)	0.641 ^c (0.262)	0.758 ^c (0.249)	-0.220 ^c (0.068)
<i>Age</i>	0.003 (0.003)	-0.003 (0.003)	0.001 (0.001)	0.002 (0.004)	-0.004 (0.004)	0.002 ^b (0.001)
<i>Size</i>	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
<i>Exp</i>	0.001 (0.001)	-0.002 (0.001)	0.001 (0.000)	0.001 (0.002)	-0.004 ^b (0.002)	0.001 ^c (0.000)
<i>For</i>	0.003 ^b (0.001)	0.003 ^c (0.001)	-0.001 ^c (0.000)	0.003 ^a (0.001)	0.003 ^a (0.001)	-0.001 ^b (0.000)
<i>Int</i>	11.608 ^b (0.110)	11.512 ^c (0.104)	0.629 ^c (0.028)	11.581 ^c (0.126)	11.411 ^c (0.124)	0.676 ^c (0.034)
R ²	0.076	0.040	0.025	0.073	0.010	
F	11.66	6.28	4.0	7.01	4.52	5.02
DWH				1.54	4.76	10.94
Prob				(0.819)	(0.313)	(0.027)
CFA				0.66	4.62	10.72
Prob				(0.418)	(0.032)	(0.001)
Obs	647	582	582	628	564	564

Notes: ^a $p < 0.1$, ^b $p < 0.05$, ^c $p < 0.01$.

Standard error in parenthesis

Durbin-Wu-Hausman (DWH) Test, (CFA)Control Function approach

Table 6. Firms' Performance and ISC (Services)

	OLS	IV-2SLS
<i>ISC</i>	0.142 (0.195)	2.711 (1.806)
<i>Age</i>	0.007 (0.005)	0.012 ^a (0.007)
<i>Size</i>	-0.001 ^b (0.000)	-0.003 ^b (0.002)
<i>Exp</i>	0.007 (0.005)	0.005 (0.006)
<i>For</i>	0.005 (0.004)	0.002 (0.006)
<i>Intercept</i>	11.485 ^c (0.112)	11.212 ^c (0.234)
R ²	0.013	
F	2.01	1.93
Observation	397	393

Notes: ^a $p < 0.1$, ^b $p < 0.05$, ^c $p < 0.01$.

Standard error in parenthesis

The results from the OLS and second-stage performance equations for all observations are presented in Table 4, whereas Table 5 reports the results for manufacturing firms. The first three columns in Tables 4 and 5 present the OLS results for *Prod1*, *Prod2*, and *COGS*; the last three columns present the second-stage results from two-stage least squares IV estimation. As expected, *ISC* positively affects *Prod1* and *Prod2* and negatively affects *COGS*. These results hold after controlling for firms' characteristics. However, among the control variables, only foreign ownership is consistently statistically significant: a 1 percentage point increase in foreign ownership increases *Prod1* and *Prod2* by about 0.3% and *COGS* by about 0.1%. The results for manufacturing firms in Table 5 are similar to those in Table 4. Table 6 shows the regression results for firms in the service sector. Unlike manufacturing firms, only *Prod1* is used as the dependent variable, as the sample sizes for *Prod2* and *COGS* are small. However, unlike firms in the manufacturing sector, the effect of *ISC* on firms' performance in the service sector is not statistically significant.

The Durbin-Wu-Hausman and Control Function Approach (CFA) are used to assess the expected endogeneity between *ISC* and firms' performance. The Durbin-Wu-Hausman statistics indicate that only *COGS* is endogenous, while CFA statistics indicate that *COGS* and *Prod2* are endogenous. However, there is no endogeneity between *ISC* and *Prod1*. Thus, OLS results are used to interpret the effects of *ISC* on *Prod1* and *Prod2*, whereas IV-2SLS results are used for *COGS*. Table 7 summarises the magnitude of *ISC*'s impacts on firms' performance for all observations and for manufacturing firms.

For *Prod1*, when all firms are used, if a firm without *ISC* obtains *ISC* (dummy of *ISC* from 0 to 1) or compares a firm with *ISC* and without *ISC*, the magnitude of *ISC*'s impact on *Prod1* is an improvement by 56.2%, holding other variables constant. And, if a firm with *ISC* stopped the certification (*ISC* from 1 to 0), the impact of the withdrawal on *Prod1* is -35.9%. For *Prod2*, if a firm without *ISC* obtains *ISC* (dummy of *ISC* from 0 to 1), the magnitude of *ISC*'s impact on *Prod2* is an improvement in performance by 48.4%. If a firm with *ISC* were to stop the certification (*ISC* from 1 to 0), the impact on *Prod2* would be -32.6%. The significant benefit of *ISC* for a firm's performance is also supported by evidence from manufacturing firms. For *COGS*, a firm with *ISC* is expected to have *COGS* 0.226 units lower than that of a firm without *ISC* across all observations. For manufacturing firms, *ISC* reduces *COGS* by 0.220 units. These results indicate that *ISC* is highly beneficial in improving firms' performance. The significant positive effect of *ISC* is also evidenced by the median gross profit per employee: RM84,507 for firms with *ISC*, compared with RM32,267 for non-*ISC* firms. Regardless of the estimation method used, the results indicate that *ISC* contribute positively to a firm's performance. Regarding the control variables, except for foreign ownership, which improves firm performance, none are consistently statistically significant.

The non-significant effects of *ISC* in the service sector are due to the distinctive characteristics of the service sector. Outputs from the service sector are intangible, heterogeneous, and co-produced through direct customer interaction, making improvements in quality or efficiency less likely to be captured by conventional productivity or cost-based indicators (Terlaak & King, 2006; Sampaio et al., 2009). Moreover, service performance relies heavily on tacit knowledge, employee discretion, and relational capabilities, which are difficult to codify and standardise through formal certification processes (Boiral, 2012; Dick, 2000). Therefore, certification may have less operational relevance in the service sector than in manufacturing, where processes are more repetitive and controllable. Studies also note that firms in the service sector often adopt *ISC* for legitimacy or signalling purposes rather than for internal efficiency (Bansal & Bogner, 2002; Rillo & Jakobs, 2023). Finally, the high degree of heterogeneity within the service sector may mask positive effects in specific sub-sectors, producing insignificant average effects in aggregate analyses (Gomez & Rodriguez, 2011).

Table 7. Percentage impact when *ISC* switches

	All observations	Manufacturing firms
	<i>ISC switches from 0 to 1</i>	
<i>Prod1</i>	56.2%	72.9%
<i>Prod2</i>	48.4%	47.4%
	<i>ISC switches from 1 to 0</i>	
<i>Prod1</i>	-35.9%	-42.2%
<i>Prod2</i>	-32.6%	-32.1%

5. CONCLUSION

This study uses WBES data for Malaysia for the period 2019-20 to examine the causal effects of *ISC* on the performance of Malaysian firms, accounting for the endogeneity between *ISC* and firm performance. Three different measures of firm performance are used to ensure

robustness: two measures of labour performance and a measure of the cost of goods sold. Sales per employee and gross profit per employee serve as the labour performance measures, and sales scale the cost of goods sold. The univariate tests show that firms with *ISC* are bigger, older, export more, and have a higher share of foreign ownership. In terms of performance, firms with *ISC* outperform those without. The fact that the performance of firms with *ISC* is better than that of those without it indicates that *ISC* has improved firms.

It is expected that *ISC* and firm performance are endogenous: more efficient firms are more likely to obtain an *ISC* and to anticipate performance gains from it. 2SLS is used to address endogeneity in multivariate analysis. Endogeneity tests indicate that *COGS* is endogenous with respect to firms' performance, whereas the labour performance measures are not. Nevertheless, results from both OLS and 2SLS, across the overall sample and manufacturing firms, indicate a positive effect of *ISC* on firm performance; however, firms in the service sector are not affected by *ISC*. As for the control variables, only foreign ownership consistently shows a positive relationship with firms' performance. 2SLS estimates from the Probit first-stage regression indicate that age, size, exporter status, and foreign ownership explain the firm-level implementation of *ISC*.

The positive impact of *ISC* suggests that the Department of Standards Malaysia (JSM), as the National Standards Body and National Accreditation Body, must promote standardisation and accreditation to enhance Malaysian firms' global competitiveness. Policymakers and standards bodies should strengthen targeted interventions to promote the adoption of certification. This may include providing financial incentives, such as certification grants, tax deductions, or cost-sharing schemes, to offset the high initial and maintenance costs of *ISC*, particularly for small and medium-sized enterprises. Sector-specific support programmes, including technical assistance, advisory services, and training tailored to manufacturing sub-sectors, can further enhance the effective use of standards. In addition, integrating *ISC* requirements into public procurement and export promotion programmes would reinforce certification as a strategic capability. At the same time, differentiated policy approaches may be needed for service-sector firms where performance gains from *ISC* are less evident.

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