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Quality standards, crime management and the efficiency of manufacturing firms in middle-income economies

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Abstract

Purpose – This study investigates the ability of crime management expenses, recognised external quality certification and ownership structure to describe the cross-sectional changes in the capital and labour efficiencies of manufacturing firms in middle income economies. It controls for the potential effects of graft incidence and firm age on firm-level efficiency.

Design/methodology/approach – The study adopts a state space model approach within the context of cross-sectional regressions. Data for the study are obtained from the World Bank Enterprise Survey for 2006, 2009, 2013, 2016 and 2019.

Findings – The study provides evidence that crime management expenses impact labour efficiency negatively. Also, its effect on capital efficiency is positive in 2019 and negative in 2013 and 2016 eras. Additionally, external auditor services and internationally recognised quality certification increase labour and capital efficiencies. Graft incidence exerts negative and positive effect on capital efficiency in the recent and earlier periods respectively. In addition, older firms tend to have higher labour efficiency, whilst younger firms have higher capital efficiency. There is evidence of firm size and export orientation effects in the drivers of efficiency.

Originality/value – Policies aimed at creating graft and crime-free business environment will enhance the efficiency and growth of firms' particularly for small firms. Also, the market rewards recognised quality assurance and good reputation.

Keywords Efficiency, Middle income economies, Bribery, Theft and vandalism, Firm ownership, Quality assurance

Paper type Research paper

1. Introduction

The study explores the influence of crime management expenses, external quality assurance, and ownership structure on manufacturing firms' labour and capital efficiencies in middle-income economies (MIEs). Firm-level efficiency is relevant for firms' productivity and survival and the economic growth of nations. For instance, efficiency improves short-term inventory evaluation and ensures optimal output from the production process, thereby maximising firm performance (Nanka-Bruce, 2011). Salas-Velasco (2018) argues that at the same level of resource deployment, an improvement in efficiency might enhance output.

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These have implications for the economic growth and development of countries. Thus, Tong (2019) observes that the variations in the production performance of firms may explain the differences in the level of efficiency of firms. Firm-level efficiency is thus essential for the development of MIEs, which are pursuing strategies to expand their economies and improve the economic wellbeing of their citizens.

The incidence of crime and its associated management costs, quality assurance measures, graft incidence and ownership structure may drive the level of efficiency of firms (Calza and Goedhuys, 2021; Saridakis *et al.*, 2015; Martincus *et al.*, 2010; Nanka-Bruce, 2011; Lin *et al.*, 2009; Dickens *et al.*, 1989). For instance, crime incidence may undermine the level of efficiency of firms. Crime such as theft and vandalism impede the progress and efficiency of firms. Saridakis *et al.* (2015) argue that firms that experience crime-related losses are less likely to adopt innovative measures to improve efficiency – that is, crime may undermine resource utilisation and thus labour productivity. Therefore, firms may invest in crime management activities to safeguard them from crime-related losses (Amin, 2010).

Similarly, quality standards and external quality certification affect the efficiency and productivity of firms. For instance, Martincus *et al.* (2010) find that ISO certification increase exports – that is, export-oriented firms profit from ISO certification. Similarly, Banker *et al.* (2014) posit that firms that adopt IFRS significantly raise their production efficiency. Liu *et al.* (2021) argue that although quality certification improves firms' profitability and operational efficiency, it does not affect competitive advantage. Contrarily, Calza and Goedhuys (2021) observe that domestic certification leads to competitive advantage for firms. Quality assurance measures such as the services of external auditors may minimise crime incidence and prevent excess capacity, thereby improving the efficiency of firms (Calza and Goedhuys, 2021; Saridakis *et al.*, 2015; Martincus *et al.*, 2010; Nanka-Bruce, 2011; Lin *et al.*, 2009; Dickens *et al.*, 1989).

The ownership structure of firms may also explain their level of efficiency. Studies such as Singh (2017), Zhou *et al.* (2017), Lin *et al.* (2009), Kinda (2012), Durand and Vargas (2003) and Yang *et al.* (2013) explore the interconnectedness between firms' ownership structure and firm-level efficiencies. Lin *et al.* and Zhou *et al.* provide evidence that state ownership reduces firm efficiency, while public and employee ownerships influence efficiency positively. Durand and Vargas (2003) indicate that owner-controlled private firms are more efficient than agent-led private firms. Similarly, Singh (2017) and Kinda (2012) argue that foreign ownership increases efficiency via capital, technology and human resources improvements.

Despite the preceding studies, limited evidence exists on the influence of quality standards, crime management and ownership structure on firm-level efficiency. None of the existing studies has analysed these issues collectively to the best of our knowledge. The focus of the existing literature has been on the relative importance of the individual constructs and the performance of firms (see, e.g. Zhou *et al.*, 2017; Omar *et al.*, 2016; Pekovic and Rolland, 2016; Gebreeyesus, 2015; Yang *et al.*, 2013). Additionally, prior studies have largely not explored the efficiency of manufacturing firms in MIEs (see, e.g. Zhou *et al.*, 2017; Lin *et al.*, 2009; Durand and Vargas, 2003). It is imperative to explore the efficiency with which firms apply labour and capital resources to realise their objectives. This is important for the growth and development of firms in MIEs since labour and capital inefficiencies may undermine the success and stability of firms with consequential outcomes for these economies. As observed by Yi and Ifft (2019), Hosseinzadeh *et al.* (2018), and Zheng and Bloch (2014), inefficiencies in resource utilisation results in higher costs and lower performance; thus, profitable firms are mostly efficient.

It may be interesting to ask, do firm size and export orientation affect the drivers of efficiency of MIEs' firms? An answer to this question will go a long way in contributing to policies promoting the growth and development of small and medium enterprises and promoting export growth in MIEs. This paper examines these issues. The study builds on the

prior studies by exploring the influence of crime management cost, quality assurance, and ownership structure on the cross-sectional variations in firms' labour and capital efficiencies in MIEs. The paper assembles data across 90 MIEs, which provides a large enough sample to ensure efficient parameter estimation. The pooling also enables us to examine any potential spatial effect on the efficiency of firms in neighbouring MIEs economies. The evidence contributes to the efficiency literature. The findings from the study are also beneficial to policymakers and managers of firms in MIEs.

The middle-income countries are structurally different from the developed economies and may offer diversification benefits to global investors. The MIEs may present unique diversification opportunities to global investors, given their structural difference from the developed economies. Structurally, inadequate technological innovations, weak governance systems, low quality of institutions, macroeconomic volatility and less developed financial system characterise the MIEs (see; Kabir and Ahmed, 2019; Vandenberg *et al.*, 2015; Su and Yao, 2017; Lin, 2017; Wang *et al.*, 2021; Aizenman *et al.*, 2018). The evidence from developed economies may therefore not apply to the MIEs. The MIEs findings, however, may apply to low-income countries. Hain and Jurowetzki (2018) and Habibov (2011) indicate that the MIEs and low-income economies are structurally similar.

The study provides evidence of significant neighbouring influence on the efficiency of firms in a given country – that is, the efficiency of firms in neighbouring economies influences firm-level efficiency in a given country. In addition, the study provides evidence that crime management expenses minimise labour efficiency. Also, crime management expenses improved capital efficiency around 2019 but reduced capital efficiency in the 2013 and 2016 eras. Additionally, MIEs' firms that rely on the services of an external auditor and hold internationally recognised quality certification have improved labour and capital efficiencies. Also, private firms, both domestic and foreign, have higher levels of efficiency. In addition, the impact of graft incidence on capital efficiency is time-varying. A negative influence of graft incidence on capital efficiency is observed in the most recent period (2016 and 2019), whereas a positive effect is observed in the 2006 and 2013 periods. Also, the effect of graft incidence on labour productivity is negative around 2006, 2013 and 2019, although positive impacts are recorded around the 2009 and 2016 periods. Also, whilst labour efficiency is high for older firms, capital efficiency tends to decrease with firm age. The study observes economically meaningful size and export effects in the influence of graft, crime management expense, firm age, access to internationally accepted quality certification and acquisition of external auditor's services on capital and labour efficiencies.

The remainder of this paper is structured in this manner. Sections 2 and 3 discuss the related literature and data, respectively. Section 4 presents the methodology of the study. The empirical results are presented in Section 5, with conclusions given in Section 6.

2. Related literature

In a recent study, Calza and Goedhuys (2021) explore the influence of quality certification on the success of small-scale enterprises. They observe that domestic standard certification led to the growth of Vietnamese small-scale firms. Calza and Goedhuys argue that domestic certification improves organisational, operational and environmental efficiencies. In addition, quality certification improves the reputation of female-run firms and hence women's empowerment in Vietnam. Similarly, Martincus *et al.* (2010) suggest that ISO certification opens new markets and promotes export growth for firms. Quality certification aid new entrants into the export market to overcome information challenges, facilitate internal efficiency and consequently improve export outcomes for firms. Similarly, Banker *et al.* (2014) study the relationship between productivity and IFRS adoption. They find that IFRS

adoption significantly improves firms' information environment and productivity – that is, international quality standards yield efficiency dividends to firms.

Quality auditing may safeguard the assets of firms and ensure efficiency. Hammami and Zadeh (2019) provide evidence of a positive effect of audit quality on firm-level efficiency. They assert that auditing influences efficiency through its supervisory function and consequent disclosure of firms' activities – this compels firms to utilise available resources efficiently. In addition, auditing ensures transparency and minimises information asymmetry, thereby ensuring higher investment efficiency. Similarly, Chen *et al.* (2020) posit that firms' internal audit functions improve operational efficiency. They note that the internal control mechanisms influence the operational efficiency of Chinese listed companies.

Studies such as Galiani *et al.* (2020), Saridakis *et al.* (2015), Islam (2014) and Amin (2010) explore the relationship between crime and firm-level efficiency and performance. These studies generally observe a negative effect of crime on firm activities. Saridakis *et al.* propose government policy interventions to minimise the incidence of crime and complement individual firms' efforts in managing crime in the work environment. Saridakis *et al.* argue that this will foster innovation, investment and entrepreneurial activities. Similarly, Galiani *et al.* (2020) suggest that firms invest in crime management systems to reduce the incidence of theft and vandalism in the firm. Islam also believes that economic growth reduces criminal activities and suggests implementing policies that promote economic growth. Islam argues that growth policies will enhance private sector business development and reduce criminal activities faced by firms. This will enable firms to reduce crime management costs and channel resources to productive use. As a result, the efficiency and performance of firms will improve. In addition, Omar *et al.* (2016) suggest close supervision, fraud awareness training, precise job descriptions, a pleasant working environment and improved security control to curtail employee crime.

Breit *et al.* (2019) examine the relationship between chief executive officers' (CEO) power and labour productivity. The authors decompose labour productivity into labour efficiency and labour cost components. They observe a positive influence of CEO power on labour efficiency. Breit *et al.* argue that more powerful CEOs exercise more influence and control over corporate operations. Such CEOs ensure cooperation and optimum employee involvement in the operations of the firm, which increase sales and labour productivity. Similarly, Mclntyre and Martin (2013) argue that firms' profitability, labour cost and labour size mainly drive the technical efficiency of firms. This appears consistent with Breit *et al.*'s observation that labour cost influences firm-level efficiency.

In a recent study, Yi and Ifft (2019) explore the impact of labour-use efficiency on the financial performance of firms. They observe a positive relationship between financial success and labour-use efficiency. The authors argue that efficient managerial strategies and the skill level of workers enhance labour efficiency, which results in improved financial success. In a related study, Yang *et al.* (2019) investigate capacity utilisation among Chinese manufacturing companies. They show that Chinese firms' capacity utilisation slightly improved due to improvements in the production technology of the manufacturing sector. They observe that excess capacity results in a higher level of inefficiencies.

Quite recently, Hosseinzadeh *et al.* (2018) examine the determinants of the efficiency of the Australian mining companies. They assert that non-operational assets or underdeveloped capacities may increase the capital stock of mining firms but have an insignificant effect on efficiency. Only assets that contribute to the production process have efficiency gains. Thus, full capacity utilisation leads to efficiency. Similarly, Zheng and Bloch (2014) investigate the decline in productivity of the Australian mining sector. They observe that firms that produce below or above capacity incur higher costs and are associated with inefficiencies.

Firms' ownership structure significantly impacts firms' management, quality assurance standards and efficiency. Kinda (2012) examines the relationship between foreign ownership

and the efficiency of firms. The author argues that foreign ownership has a positive effect on efficiency. The author suggests that the efficiency of foreign firms relative to domestic ones results from the favourable investment climate provided by the host country's government, which is mostly not available to local companies. In a similar study, Singh (2017) suggests that foreign-owned firms promote total and labour productivity in the host country. Durand and Vargas (2003) show that owner-controlled private firms are more efficient than agent-led private firms.

Zhou *et al.* (2017) employ two longitudinal panel datasets of Chinese firms to examine the association between state ownership and firm efficiency. Zhou *et al.* argue that state-owned firms are less efficient. Despite the significant level of resources available, they contend that state-owned firms are less innovative and inefficient. The authors find that state ownership promotes research and development activities, but such investments do not translate into innovation and efficiency – that is, state ownership does not lead to efficient resource utilisation. They argue that firms with minority state ownership are most innovative and efficient. Similarly, Su and He (2012) and Lin *et al.* (2009) find a negative relationship between state ownership and firm efficiency and a positive association between public and employee ownership and firm efficiency. Controlling for age, Yang *et al.* (2013) note a negative relationship between private ownership and efficiency, contrary to Zhou *et al.* (2017).

This paper looks at a relatively novel area of firm efficiency and how quality standards, crime management and ownership structure independently and cumulatively affect efficiency. This contribution is unique to this paper.

3. Data and descriptive statistics

The data for the study are collected from the World Bank Enterprise Survey database. We collected data for 2006, 2009, 2013, 2016 and 2019 periods. Although data were available over the 2006–2020 periods, we excluded any year with data on less than 18 countries (see Table A5, Appendix). The approach enabled us to assemble enough data for each year, which helped improve the power of the tests conducted in this study. Data on annual labour productivity growth (LPROD), capital utilisation (CAPUTI), security cost as a percentage of annual sales (SCSALES), percentage of firms with internationally recognised quality certification (QCERT), percentage of firms with annual financial statements reviewed by an external auditor (EXAUDIT), age of the firm in years (AGE), the proportion of private domestic ownership in a firm (PDOM), the proportion of private foreign ownership in a firm (PFOR), the proportion of government/state ownership in a firm (GOV), and graft index (GRAFT) were collected from the database.

The descriptive statistics of the data are presented in Table 1. The Table shows that the cross-sectional mean of LPROD is negative for all years excluding 2016. It ranges from −36.2% (2013) to 9.3% (2016). The cross-sectional standard deviation of LPROD was lowest in 2006 (18.73) and highest in 2009 (26.13). The evidence shows that LPROD in MIEs is low and highly volatile, although the volatility level has decreased moderately in the recent period. The Table shows that the lowest (57.73) and highest (71.33) capital utilisation are recorded in 2006 and 2016, respectively. The variability of CAPUTI ranging from 28.37 (2016) to 37.63 (2009) is quite high. In addition, Table 1 indicates that MIEs' firms invested 12.65% (2006) to 16.71% (2019) of annual sales in managing theft and vandalism. The security expenditure is generally less volatile (ranging from 3.24 in 2006 to 4.375 in 2019) but economically meaningful. The proportion of annual sales invested in crime management is generally high and may hurt the efficiency of MIEs' firms. This, combined with the observed low labour productivity, may constrain the growth of MIEs' firms.

Table 1 indicates that the highest and lowest proportions of firms with international quality certification are, respectively, 16.4% (2006) and 27.0% (2009). Similarly, the

Table 1.
Descriptive statistics

	LPROD	CAPUTI	SCSALES	QCERT	EXAUDIT	AGE	PDOM	PFOR	GOV	GRAFT	AGELG
Panel A: Descriptive statistics for 2006											
Mean	−1.698	57.739	1.265	0.164	0.471	19.110	0.860	0.098	0.004	5.405	2.561
Standard deviation	18.738	33.376	3.239	0.371	0.499	17.239	0.331	0.280	0.053	20.463	0.952
Skewness	0.321	−0.653	7.352	1.810	0.117	2.117	−2.070	2.686	16.979	3.944	−0.499
Kurtosis	5.570	2.150	93.094	4.277	1.014	9.985	5.447	8.504	304.090	17.549	3.138
Panel B: Descriptive statistics for 2009											
Mean	−0.979	59.522	1.342	0.222	0.432	17.816	0.795	0.114	0.010	8.398	2.542
Standard deviation	26.133	37.626	4.037	0.415	0.495	15.952	0.384	0.299	0.072	25.140	0.870
Skewness	0.316	−0.613	9.496	1.340	0.273	2.553	−1.455	2.415	8.717	2.974	−0.491
Kurtosis	6.017	1.834	145.365	2.795	1.074	13.466	3.250	7.077	85.415	10.483	3.664
Panel C: Descriptive statistics for 2013											
Mean	−3.621	62.367	1.520	0.261	0.513	18.096	0.899	0.074	0.006	6.873	2.582
Standard deviation	23.001	33.254	4.215	0.439	0.500	14.077	0.281	0.242	0.060	24.272	0.880
Skewness	0.380	−0.788	7.244	1.088	−0.051	1.839	−2.620	3.233	11.986	3.402	−0.844
Kurtosis	7.900	2.360	92.384	2.184	1.003	8.749	8.219	11.977	162.471	12.894	3.965
Panel D: Descriptive statistics for 2016											
Mean	0.093	71.332	1.415	0.231	0.583	22.337	0.871	0.091	0.005	6.023	2.824
Standard deviation	22.883	28.368	3.687	0.422	0.493	16.708	0.310	0.263	0.054	22.810	0.832
Skewness	0.418	−1.033	4.757	1.275	−0.337	1.845	−2.201	2.839	12.039	3.695	−0.949
Kurtosis	7.025	3.324	33.345	2.626	1.113	8.028	6.169	9.543	163.273	15.020	4.763
Panel E: Descriptive statistics for 2019											
Mean	−1.454	65.502	1.671	0.270	0.343	17.970	0.894	0.067	0.005	4.048	2.585
Standard deviation	20.963	32.366	4.375	0.444	0.475	14.384	0.284	0.228	0.054	18.810	0.850
Skewness	0.510	−0.904	4.920	1.036	0.662	2.298	−2.541	3.441	11.906	4.646	−0.724
Kurtosis	9.498	2.645	35.608	2.073	1.438	11.948	7.841	13.484	159.329	23.171	3.763

Note(s): This Table presents the correlation matrix of the variables employed in the study. LPROD, CAPUTI, SCSALES, AGE, and GRAFT are, respectively, annual labour productivity growth, percentage capital utilisation, security cost as a percentage of annual sales, firm age in years, and graft index. QCERT and EXAUDIT are, respectively, the percentage of firms with internationally recognised quality certification and the percentage of firms with annual financial statements reviewed by an external auditor. Also, PDOM, PFOR, and GOV are the proportion of private domestic ownership, private foreign ownership, and state ownership in a firm, respectively

proportion of firms employing the services of external auditors ranges from 34.3% in 2019 to 58.3% in 2016. The evidence shows that fewer MIEs' firms have internationally recognised quality certification. In addition, the proportion of firms relying on external auditor services has decreased in recent years. These may undermine quality standards among MIEs' firms. Additionally, the average age of MIEs' firms ranges from 17 (2009) to 22 (2016) years. This indicates that MIEs' firms are relatively young. These firms may therefore have high growth potential due to unexplored opportunities. In addition, these firms may have limited experience, which could undermine their levels of efficiency and productivity. The average graft index ranges from 4.1 (with a volatility of 18.81) in 2019 to 8.4 (with a volatility of 25.14) in 2009. The evidence indicates that the variability of graft incidence is generally high.

Table 2 presents the correlation matrix of the studied variables. The Table shows that labour productivity has negative correlations with security cost as a percentage of sales, private domestic ownership, age of the firm and graft incidence. It, however, correlates positively with private foreign ownership, quality certification, external auditor services and government ownership. The evidence suggests that foreign and government ownership and improved quality standards improve labour efficiency. However, private domestic ownership, graft incidence and firm age reduce labour efficiency.

That is, privately-owned domestic firms are associated with lower labour productivity. This appears consistent with prior studies such as Islam *et al.* (2019) but inconsistent with Ugwu and Omeje (2021).

The Table indicates further that exempting security cost as a percentage of annual sales, foreign and government ownership and graft incidence, capital utilisation exhibits positive correlations with all the other variables. Unlike labour efficiency, private domestic ownership and firm age positively affect capital efficiency. In addition, PDOM correlates positively with capital utilisation and negatively with labour productivity. The evidence implies that privately-owned domestic firms have higher capital utilisation levels than government and foreign-owned firms. Also, domestically owned private firms have lower labour productivity than private foreign firms. Additionally, graft incidence correlates negatively with privately-owned domestic firms, government-owned firms, and firm age but positively with foreign-owned firms, external auditor services and quality certification. These findings may imply that older firms are less involved in graft incidence than younger ones. Additionally, foreign-owned firms may pay bribes to secure government contracts. Also, firms may pay bribes to secure internationally recognised quality certification and positive external auditors' reports. This appears consistent with the observed correlations between foreign ownership and quality certification (0.1262), foreign ownership and external auditor services' (0.1168), private domestic ownership and quality certification (−0.1041) and private domestic ownership and external auditor engagement (−0.0897).

The Table shows that the absolute correlations are generally low, ranging from 0.0003 (LPROD and GRAFT) to 0.7689 (PDOM and PFOR). Aside from the correlations between PDOM and PFOR, all the absolute correlations are less than 0.3. This shows that multicollinearity impacts less on the results of the study.

4. Methodology

The study employs Equation (1), a cross-sectional spatial lag model, to investigate the drivers of firm-level efficiency in MIEs. The spatial lag model helps examine the spatial dependencies in the efficiency of manufacturing firms in MIEs. Thus, Equation (1) captures the effect of country i's firms' efficiency on the efficiency of country j's firms. The spatial lag model was selected based on Bera and Yoon (1993), and Anselin *et al.* (1996) proposed robust LM test. The adjacency matrix (w) captures the influence of country i on neighbouring country j's firm's efficiency. The spatial specific effects (μ) control for space-specific time-invariant factors.

Table 2. Correlation matrix

	LPROD	CAPUTI	SCSALES	QCERT	EXAUDIT	PDOM	PFOR	GOV	AGELG
LPROD	1								
CAPUTI	0.0007	1							
SCSALES	−0.0106	−0.0461	1						
QCERT	0.0139	0.0847	−0.0008	1					
EXAUDIT	0.0057	0.0553	0.0077	0.2436	1				
PDOM	−0.0210	0.0783	−0.0444	−0.1041	−0.0897	1			
PFOR	0.0217	−0.0169	0.0209	0.1262	0.1168	−0.7689	1		
GOV	0.0104	−0.0037	0.0069	0.0610	0.0378	−0.2116	−0.0052	1	
AGELG	−0.0056	0.0557	−0.0052	0.1413	0.1501	0.0190	−0.0222	0.0352	1
GRAFTLG	−0.0003	−0.0151	0.0435	0.0066	0.0258	−0.0156	0.0220	−0.0055	−0.0274

Note(s): The Table presents the correlation matrix of the variables employed in the study. LPROD, CAPUTI, SCSALES, AGE and GRAFT are, respectively, annual labour productivity growth, percentage capital utilisation, security cost as a percentage of annual sales, age of the firm in years, and graft index. QCERT and EXAUDIT are respectively the percentage of firms with internationally recognised quality certification and the percentage of firms with annual financial statements reviewed by an external auditor. Also, PDOM, PFOR, and GOV are the proportion of private domestic ownership, private foreign ownership, and state ownership in a firm, respectively

The spatial model is preferred due to its ability to control for spatial dependencies in the performance of firms. Controlling for spatial dependencies is appropriate given that the sample consists of economies from diverse geographic regions. The technique appropriately controls spatial autocorrelation and spatial heterogeneity, which are common in cross-sectional data (Anselin *et al.*, 1996; Anselin, 2001; Floch and Le Saout, 2018). Standard econometric techniques do not control for spatial effects and may provide less precise or biased estimators in the presence of spatial autocorrelation (Anselin, 2001; LeSage and Pace, 2009).

$$\mathrm{EFF}_{\mathrm{i}}^{\mathrm{j}} = \alpha_0 + \gamma \sum_{\mathrm{i}=1}^{\mathrm{N}} \mathrm{w}_{\mathrm{j,i}}\mathrm{EFF}_{\mathrm{i}} + \beta^1\mathrm{CMAN}_{\mathrm{j}} + \beta^2\mathrm{QCT}_{\mathrm{j}} + \beta^3\mathrm{EAS}_{\mathrm{j}} + \beta^4 PDOM_j + \beta^5 PFOR_j + \beta^6 GOV_j + \beta^7\mathrm{AGL}_{\mathrm{j}} + \beta^8\mathrm{GIL}_{\mathrm{j}} + \mu_j + \varepsilon_j \quad (1)$$

$$EFF = efficiency, a = intercept, \beta = coefficients, CMAN = crime\ \ management,$$
$$QCERT = quality\ \ certification, EAS = External\ \ auditor\ \ services,$$
$$PDOM = private\ \ domestic\ \ ownership, PFOR = privateforeignownership,$$
$$GOV = government\ \ ownership, AGL = \log of\ firm'sage, GIL = Logofgraftindex,$$
$$\mu = spatialspecificeffects, \gamma = the\ \ spatial\ \ autocorrelation\ \ coefficient,$$
$$w_{j,i} = element\ of\ the\ adjacencymatrix\ \ W.$$

Our proxies for efficiency (EFF), crime management (CMAN), quality certification (QCT), and external auditor services (EAS), respectively, are LPROD or CAPUTI, SCSALES, QCERT and EXAUDIT. We use LPROD and CAPUTI as the respective proxies for labour and capital efficiencies. Labour productivity and capital utilisation effectively capture the efficiency of labour and capital, respectively. Hosseinzadah *et al.* (2018) and Zheng and Bloch (2014) observe that full capital utilisation implies efficiency. Similarly, higher labour productivity implies efficient utilisation of labour. Labour is most efficient at the highest level of labour productivity. Our efficiency proxies are thus appropriate.

5. Empirical results

We examine the influence of crime management, quality certification, and firm ownership on manufacturing firms' labour and capital efficiencies in MIEs by estimating Equation (1). The results for labour and capital efficiencies are presented in Tables A1 and A2, respectively. Table A1 indicates that the spatial lag coefficient is statistically significant across all years and for all estimated models, excluding one case in 2019. In addition, excluding 2019, crime management loads significantly and negatively on labour efficiency. The effect of crime management on labour efficiency is insignificant only in 2019. Similarly, the influence of graft incidence on labour efficiency is not consistent across the different years. Aside from 2009 to 2019, the effect of graft on labour productivity is statistically meaningful. The effect of graft incidence on labour productivity is negative in 2006, 2013 and 2019 but positive in 2009 and 2016. The positive relationship between graft incidence and labour productivity may imply that graft incidence facilitates firms' access to new opportunities. The negative graft incidence coefficients suggest that graft incidence did not contribute significantly to labour productivity. Such bribe payments may not be related directly to the output of labour. This negative finding is in agreement with Sharma and Mitra (2015), Cooray and Dzhumashev (2018) and Nhung and Phuong (2021). Interestingly, the graft coefficient changes sign in approximately every three years. The Table shows that, in general, firms'

age impact labour efficiency (particularly in the 2009–2013 periods), which is consistent with the findings of Faruq and David (2010).

Table A1 shows that international quality certification enhanced labour efficiency over the 2006–2019 period, which is consistent with prior studies such as Sanchez-Ollero *et al.* (2015), Gallego and Ramirez (2021), Ali and Yusuf (2021), Trifkovic (2017) but inconsistent with Albulescu *et al.* (2016) who found no effect of quality certification on labour productivity. Similarly, excluding 2013, the loading of labour efficiency on external auditor engagement is positive, which supports the findings of Morris (2018) and Ndiaye *et al.* (2018). In addition, labour efficiency is independent of firm ownership.

Consistent with the evidence in Table A1, Table A2 records a significant spatial lag coefficient across all years and models that we examined. The labour and capital efficiency of neighbouring countries impact the level of efficiency in a given country. This may be driven by similar institutional, cultural and development states of contiguous MIEs. The Table indicates that capital utilisation decreases with firm age across all the investigated years – that is, as MIEs' firms grow, capital efficiency decreases. This is, however, inconsistent with Hosseinzadeh *et al.* (2018). The effect of age on capital efficiency is stronger than its effect on labour efficiency. MIEs' firms may accumulate a significant amount of capital with age, but the accumulation coincides with declining investment opportunities – that is, MIEs' firms acquire excess capacity with age, thereby reducing capital efficiency.

Table A2 indicates that CMAN influenced capital efficiency significantly in 2013, 2016 and 2019. The coefficients are, however, positive for only 2019 – that is, crime management improved capital utilisation in 2019 but decreased capital utilisation in 2013 and 2016. Possibly, crime management activities were more efficient in preventing crimes against the firm in 2019 relative to 2013 and 2016. The evidence in the Table shows that capital utilisation is indifferent to firm ownership. For instance, in 2006 and 2009, capital efficiency decreased with each ownership category. The evidence that capital efficiency is independent of ownership structure is mainly consistent with the labour efficiency evidence in Table A1. However, the sign of the influence of ownership structure on capital and labour efficiencies is opposite. Table A2 provides evidence of significant and positive QCT coefficients between 2009 and 2019. Similarly, the EAS coefficients were significantly positive in 2006 and negative in 2009.

5.1 Size effect in the efficiency of firms in middle-income economies

The results presented in Tables A1 and A2 may have a potential size effect – that is, different factors may describe the efficiency of firms of different size categories. We explore this using Equation (2). We rely on a size dummy (D) which takes the value of 1 for large firms and 0 otherwise. The results from Equation (2) estimation are presented in Table A3. Panels A and B of the Table, respectively, record the results of labour and capital efficiencies.

$$\begin{aligned}\mathrm{EFF}_{\mathrm{i}}^{\mathrm{j}} = {} & \alpha_0 + \gamma \sum_{\mathrm{i}=1}^{\mathrm{N}} \mathrm{w}_{\mathrm{j},\mathrm{i}}\mathrm{EFF}_{\mathrm{i}} + \beta^1\mathrm{CMAN}_{\mathrm{j}} + \beta^2\mathrm{QCT}_{\mathrm{j}} + \beta^3\mathrm{EAS}_{\mathrm{j}} + \beta^4 PDOM_j + \beta^5 PFOR_j \\ & + \beta^6 GOV_j + \beta^7\mathrm{AGL}_{\mathrm{j}} + \beta^8\mathrm{GIL}_{\mathrm{j}} + D_j\left(\lambda^1\mathrm{CMAN}_{\mathrm{j}} + \lambda^2\mathrm{QCT}_{\mathrm{j}} + \lambda^3\mathrm{EAS}_{\mathrm{j}} + \lambda^4 PDOM_j\right. \\ & \left. + \lambda^5 PFOR_j + \lambda^6 GOV_j + \lambda^7\mathrm{AGL}_{\mathrm{j}} + \lambda^8\mathrm{GIL}_{\mathrm{j}}\right) + \mu_j + \varepsilon_j \end{aligned} \tag{2}$$

$D = \textit{firm size dummy}$. It takes the value of 1 for large firms and 0 otherwise. Firms are classified into various size categories in the database.

Panel A (Table A3) shows that the influences of GIL, CMAN, AGL, GOV and EAS are not significantly different across the different size groups. Additionally, the QCT effect varied

significantly between the different size categories in 2019. Although the QCT influence is positive for all firms, the impact is higher for the smaller firms in 2006 and 2019 – additionally, PDOM and PFOR impact small and large firms' efficiency differently. The evidence shows that large domestic-owned firms were more/less efficient than the small domestic-owned firms in 2006/2019. Labour efficiency increased with private domestic ownership in 2006, but the increase was higher for larger firms. Similarly, an increase in private domestic ownership coincided with a decline in efficiency in 2019. However, the impact appeared lesser for the smaller firms. Additionally, large foreign-owned firms were more efficient than small foreign-owned firms in 2006 and 2019.

The evidence infers that graft incidence impairs the labour efficiency of all firms. The small/big firm evidence appears inconsistent/consistent with Aterido *et al.* (2011), who observed positive and negative effects of bribe payment on small and large firms, respectively. In addition, labour efficiency increased with international quality certification for the smaller firms in all years. However, for the larger firms, labour efficiency decreased with international quality certification in 2019, although it increased with it in 2006. Additionally, the services of an external auditor improved the labour efficiency of both the smaller and bigger firms. Also, labour efficiency respectively improved and decreased with the age of smaller firms in 2006 and 2019. The 2006 findings contradict Herrera and Kouamé (2017). The findings suggest that rising crime management expenses minimised labour productivity in 2006. This corroborates/contradicts Moyo (2012) for smaller/larger firms. In sum, the findings suggest a statistically distinguishable size effect in the PDOM, PFOR and QCT effects on labour efficiency. Additionally, there is a statistically insignificant size effect in the influence of GIL, CMAN, AGL, GOV and EAS on efficiency. However, the observed effects in all the drivers of labour efficiency seem economically meaningful.

Panel B (Table A3) provides evidence of an insignificant spread in the capital efficiency loadings on GIL, GOV and EAS across the firm size groups – that is, there is a statistically insignificant difference in the impact of GIL, GOV and EAS on the capital efficiency of firms across the size groups. Additionally, the CMAN and QCT effects significantly varied between the small and large firms only in 2006. These variables, respectively, impacted the small and large firms' efficiency negatively and largely positively in 2016. However, they enhanced the efficiency of all firms in 2019. Additionally, there is a statistically distinguishable difference in the influence of PDOM and PFOR on small and large firms' capital efficiencies. Although the PDOM and PFOR effects are positive for all firms, the effects are higher for larger firms.

Table A3 indicates the size effect in the cross-sectional descriptive abilities of CMAN, QCT, PDOM and PFOR for capital efficiency. Consistent with the labour efficiency evidence, there exists a statistically indistinguishable size effect in the influence of GOV, GIL and EAS on capital efficiency. In addition, the evidence indicates that external auditor's services improved/impaired capital efficiency in the recent/earlier era, which corroborates the results of Hallward-Driemeier *et al.* (2002). The evidence suggests that graft incidence reduced capital efficiency across all size groups, consistent with Kato and Sato (2014). Also, crime management expenses reduced and increased the capital efficiency of smaller firms respectively in 2016 and 2019. Its effects on the efficiency of larger firms are significant only in 2016.

5.2 Export effects in the efficiency of firms in middle-income economies

We further explore the potential exports' effect in the results presented in Table A2 via Equation (3). The results of estimating Equation (3) are presented in Table A4. Panel A (Table A4) records the results for labour efficiency. Panel A provides no evidence of a statistically significant exports' effect in the influence of GIL and CMAN on labour efficiency. Additionally, we observe significant variation in the impact of firm age on the efficiency of the

exporting and non-exporting firms in 2 out of the 4 examined cases. In addition, the difference in the ability of QCT to describe efficiency across the export categories is distinguishable only in 2019. Although QCT positively impacted non-exporting firms' efficiency, its effects on exporting firms' efficiency are negative in 2019. The 2006 evidence indicates a positive QCT influence on efficiency, which is not statistically different across the export orientation groups though economically distinguishable.

$$\begin{aligned} \mathrm{EFF}_{\mathrm{i}}^{\mathrm{j}} = {} & \alpha_0 + \gamma \sum_{\mathrm{i}=1}^{\mathrm{N}} \mathrm{w}_{\mathrm{j},\mathrm{i}} \mathrm{EFF}_{\mathrm{i}} + \beta^1 \mathrm{CMAN}_{\mathrm{j}} + \beta^2 \mathrm{QCT}_{\mathrm{j}} + \beta^3 \mathrm{EAS}_{\mathrm{j}} + \beta^4 PDOM_j + \beta^5 PFOR_j \\ & + \beta^6 GOV_j + \beta^7 \mathrm{AGL}_{\mathrm{j}} + \beta^8 \mathrm{GIL}_{\mathrm{j}} + E_j \left(\lambda^1 \mathrm{CMAN}_{\mathrm{j}} + \lambda^2 \mathrm{QCT}_{\mathrm{j}} + \lambda^3 \mathrm{EAS}_{\mathrm{j}} + \lambda^4 PDOM_j \right. \\ & \left. + \lambda^5 PFOR_j + \lambda^6 GOV_j + \lambda^7 \mathrm{AGL}_{\mathrm{j}} + \lambda^8 \mathrm{GIL}_{\mathrm{j}} \right) + \mu_j + \varepsilon_j \end{aligned} \tag{3}$$

$E = exports\ \ dummy$. It takes the value of 1 for exporting firms and 0 otherwise. Firms are classified as exporting or non-exporting in the database.

The QCT effect is respectively positive and negative for the non-exporting and exporting entities in 2019, which contradicts Ullah *et al.* (2014). Ullah *et al.* show a positive relationship between quality certification and labour productivity of exporting firms. Panel A shows evidence of the differential impact of EAS on labour efficiency across the export groups only in 2016. Though labour efficiency rose with EAS for all firms in 2016, the effect is relatively high for the non-exporting group. Also, there exists a statistically distinguishable difference in the PDOM and PFOR coefficients across the export categories, mainly in 2016. The evidence suggests a significant exports' effect in the QCT, EAS, PDOM and PFOR influence on labour efficiency in some but not in all cases. Panels A of Tables A3 and A4 together may imply that the smaller firms are largely non-exporting and that these smaller-non-exporting firms enhance labour efficiency by acquiring internationally recognised quality certification and the services of an external auditor. This is consistent with the findings of Masakure *et al.* (2011).

Table A4 (Panel B) shows that CMAN drives the cross-sectional changes in the capital efficiency of the export groups differently in 3 out of 6 instances. CMAN respectively constraints and improves capital efficiency in 2016 and 2019 irrespective of export orientation, though the effect is more substantial for the non-exporting firms. The 2019 results corroborate Moyo's (2012) evidence. Also, the variations in the efficiency loadings on GIL and EAS between the export categories are statistically indistinguishable, although it appears meaningful economically. The 2016 results infer that the capital efficiency of the exporting firms decreased more than that of the non-exporting ones with rising GIL. However, the 2019 findings show a more substantial negative impact of GIL on the efficiency of the non-exporting firms compared to the exporting ones. The GIL evidence is consistent with the findings of Lee and Weng (2013) and Imran *et al.* (2019). Also, the EAS influence is generally more decisive for exporting relative to the non-exporting companies. Panel B provides evidence of a statistically distinguishable exports' effect in the QCT coefficients only in 2016, but the difference is economically meaningful for 2006 and 2019. Rising QCT leads to an increase in the capital efficiency of exporting firms in 2006 and 2019. It, however, leads to a decline and an increase in the non-export focused firm's efficiency in 2006 and 2019 correspondingly. The findings generally corroborate Chen *et al.* (2008) and Pekovic and Rolland (2016). Also, the PDOM and PFOR coefficients vary between the exporting and non-exporting entities in 2 out of 4 explored cases.

6. Conclusions

The study explores the ability of crime management cost, graft incidence, international quality certification, external auditor services, and ownership structure to describe the cross-sectional variations in manufacturing firms' labour efficiency (labour productivity) and capital efficiency (capital utilisation) in MIEs. It also explores the potential effects of firm size and export orientation on the drivers of efficiency. The study examines potential spatial effects in the efficiency of firms. The evidence shows significant spatial effects in firms' labour and capital efficiencies – that is, the level of efficiency in a given country is influenced by those in neighbouring economies. The spatial effects may be driven by cultural factors and similar economic structures of neighbouring economies. This suggests some level of integration of the MIEs.

The study shows that rising crime management cost reduces labour efficiency. Similarly, crime management expenses had a beneficial effect on capital utilisation in 2019 but a negative impact in 2013 and 2016. Additionally, capital efficiency increased with graft incidence in 2006 and 2013, although efficiency declined with rising graft incidence in the 2016 and 2019 periods. Also, graft incidence influenced labour productivity negatively in 2006, 2013 and 2019; however, positive effects were observed in 2009 and 2016 – that is, the efficiency cost of graft incidence is not straightforward. However, it is interesting to observe that the sign of the graft incidence coefficients (for labour efficiency) changes almost every three years. This may suggest that it takes approximately three years for the graft to impact labour productivity. The benefit of the graft may be observed when the associated projects are completed. The three-year cycle may coincide with the graft-related projects' maturity period. For instance, a graft incidence in 2006 may negatively shock labour efficiency in 2006 but positively shock in 2009 as the related project matures.

The evidence shows that firms that acquire the services of external auditors and recognised international quality certification have improved labour and capital efficiencies in most of the years. Quality assurance by independent external entities leads to better efficiency outcomes. Also, as firms grow, labour efficiency rises, but capital efficiency decreases. Maturing MIEs' firms may acquire excess capacity, thereby reducing capital utilisation. Further evidence is provided that labour and capital efficiencies are influenced by private domestic and foreign ownership but not government ownership.

The study provides evidence of a statistically significant size effect in the ability of private domestic ownership, private foreign ownership and recognised international quality certification to describe the cross-sectional changes in labour and capital efficiencies. In addition, there is an insignificant size effect in the ability of graft incidence, firm age, government ownership and external auditor engagement to describe labour and capital efficiencies. The size effect in the descriptive ability of crime management is statistically significant for capital efficiency, although the effect is insignificant for labour efficiency. In addition, we observe statistically distinguishable exports' effect in the ability of internationally recognised quality certification, external auditor engagement, private domestic ownership, private foreign ownership and firm age to capture the cross-sectional changes in labour efficiency in most cases. The study shows no evidence of statistically distinguishable exports' effect in the graft incidence and crime management influence on labour efficiency. Also, the observed export effects in the impact of external auditor engagement and graft incidence on capital efficiency are indistinguishable statistically. Additionally, the coefficients of quality certification, crime management, private domestic ownership and private foreign ownership vary significantly between the exporting and non-exporting entities in some cases. The study shows that the size and export effects in the drivers of labour and capital efficiencies seem economically meaningful even in instances where the effects are indistinguishable statistically.

The findings have implications for policymakers and managers in MIEs. The evidence shows that a surge in crime management costs impairs both labour and capital efficiencies in most cases. Also, small non-exporting firms suffer most from crime management expenses and graft incidence. Policies aimed at improving the efficiency of firms should address problems relating to graft incidence and crime management expenses. It is thus essential for policy to focus on reducing crime incidence and thus the related crime management costs by firms. Efforts at minimising graft incidence and reducing crime management expenses will enhance the efficiency of firms, particularly the small and non-exporting ones. Additionally, managers, particularly of smaller firms, could improve labour productivity and capital utilisation via the engagement of external auditors and internationally recognised quality certification – that is, the market rewards recognised quality assurance. Investors and consumers may associate an excellent reputation with external quality assurance measures. In addition, managers need to implement measures to prevent excess capacity as firms' age.

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Appendix

Table A1. Drivers of labour efficiency

Year	Model	α	W*EFF	GIL	CMAN	AGL	QCT	EAI	PDOM	PFOR	GOV
Panel A: 2006	1	−4.014***	0.075***	−0.501***	−0.276***	0.456**	1.840***	3.147***			
Results	2	−5.560***	0.082***	−0.538***	−0.219***				4.506***	5.663***	5.550
	3	−9.220***	0.070***	−0.517***	−0.242***	0.354	1.831***	3.441***	5.525***	5.225***	5.058
Panel B: 2009	1	−2.810***	0.034***	0.060	−0.281***	0.643**	0.361	1.151*			
Results	2	−3.238***	0.034***	0.046	−0.270***				2.595**	4.146***	9.882**
	3	−5.424***	0.034***	0.038	−0.274***	0.721**	0.126	0.792	2.628**	3.940***	8.898**
Panel C: 2013	1	−0.065	0.040***	−0.443**	−0.089*	−1.223***	2.814***	−1.360***			
Results	2	−0.958	0.041***	−0.453***	−0.091*				−2.521*	0.909	−3.127
	3	1.550	0.039***	−0.480***	−0.095*	−1.157***	2.640***	−1.493***	−1.918	1.177	−2.482
Panel D: 2016	1	−1.446	0.055***	0.630**	−0.198**	0.196	0.245	1.729**			
Results	2	−0.998	0.056***	0.664**	−0.164*				1.140	0.981	5.691
	3	−2.336	0.054***	0.631**	−0.196**	0.166	0.252	1.753**	1.024	0.432	4.757
Panel E: 2019	1	−0.511	0.009***	−0.064	0.056	−0.511*	0.629	0.410			
Results	2	−0.543	0.008	−0.048	0.052				−1.208	0.873	8.608*
	3	0.348	0.008***	−0.063	0.055	−0.484*	0.506	0.304	−1.073	0.823	8.675**

Note(s): The Table presents the results of estimating the equation

$$\mathrm{EFF}_i^j = \alpha_0 + \gamma \sum_{i=1}^{N} \mathrm{w}_{j,i}\mathrm{EFF}_i + \beta^1\mathrm{CMAN}_j + \beta^2\mathrm{QCT}_j + \beta^3\mathrm{EAS}_j + \beta^4 PDOM_j + \beta^5 PFOR_j + \beta^6 GOV_j + \beta^7\mathrm{AGL}_j + \beta^8\mathrm{GIL}_j + \mu_j + \varepsilon_j$$

EFF = labourefficiency, QCT = qualitycertification, CMAN = crimemanagement, GIL = LogofgraftindexAGL = log *offirm'sage, a = intercept, EAS = Externalauditorservices,* γ *= thespatialautocorrelationcoefficient,* μ *= spatialspecificeffects, GOV = governmentownership,* β *= coefficients, PDOM = privatedomesticownership, PFOR = privateforeignownership,* $w_{j,i}$ *= elementoftheadjacencymatrix W.*

***, ** and * are 1, 5 and 10% significant levels respectively

Table A2.
Drivers of capital efficiency

Year	Model	α	W*EFF	GIL	CMAN	AGL	QCT	EAI	PDOM	PFOR	GOV
Panel A: 2006 Results	1	8.373***	0.020***	0.435***	0.041	−1.362***	0.016	0.714**			
	2	7.087***	0.021***	0.472***	0.038				−1.858**	−2.639***	−5.761**
	3	9.516***	0.021***	0.444***	0.033	−1.368***	0.237	0.753**	−1.087	−2.346**	−4.574
Panel B: 2009 Results	1	12.320***	0.015***	0.189	0.047	−2.871***	0.778	−1.800***			
	2	8.744***	0.017***	0.249*	0.029				−4.436***	−5.805***	−15.855***
	3	17.085***	0.014***	0.229	0.036	−2.999***	1.070**	−1.252***	−4.875***	−6.384***	−14.176***
Panel C: 2013 Results	1	4.986***	0.052***	0.289**	−0.133***	−1.189***	1.567***	0.356			
	2	2.720***	0.051***	0.328***	−0.129***				−0.257	0.323	−3.623
	3	4.908***	0.051***	0.287**	−0.133***	−1.179***	1.597***	0.362	0.063	0.075	−3.257
Panel D: 2016 Results	1	66.678***	0.142***	−0.130	−0.312***	−1.371***	6.634	−4.549			
	2	48.257***	0.156***	−0.165	−0.320***				12.738	14.746	−9.116
	3	53.467***	0.139***	−0.112	−0.264**	−1.068**	6.626	−4.842	12.956	14.999	−9.329
Panel E: 2019 Results	1	6.696***	0.030***	−0.043	0.089**	−1.705***	0.735**	−0.239			
	2	1.755**	0.033***	−0.074	0.084**				0.639	1.513	−2.579
	3	5.765***	0.033***	−0.046	0.088**	−1.702***	0.705*	−0.226	0.925	1.556	−1.846

Note(s): The Table presents the results of estimating the equation

$$\mathrm{EFF}_{\mathrm{i}}^{\mathrm{j}} = \alpha_0 + \gamma \sum_{\mathrm{i}=1}^{\mathrm{N}} \mathrm{w}_{\mathrm{j,i}} \mathrm{EFF}_{\mathrm{i}} + \beta^1 \mathrm{CMAN}_{\mathrm{j}} + \beta^2 \mathrm{QCT}_{\mathrm{j}} + \beta^3 \mathrm{EAS}_{\mathrm{j}} + \beta^4 PDOM_j + \beta^5 PFOR_j + \beta^6 GOV_j + \beta^7 \mathrm{AGL}_{\mathrm{j}} + \beta^8 \mathrm{GIL}_{\mathrm{j}} + \mu_j + \varepsilon_j$$

$EFF = capitalefficiency, QCT = quality\ \ certification, CMAN = crimemanagement, GIL = LogofgraftindexAGL = \log offirm'sage, a = intercept,$
$EAS = Externalauditorservices, \gamma = thespatialautocorrelationcoefficient, \mu = spatialspecificeffects, GOV = governmentownership,$
$\beta = coefficients, PDOM = privatedomesticownership, PFOR = privateforeignownership, w_{j,i} = elementoftheadjacencymatrix\ \ W.$
***, ** and * are 1, 5 and 10% significant levels respectively

Table A3.
Size effect in the labour and capital efficiencies of firms

	Panel A: Labour efficiency						Panel B: Capital efficiency					
	2006			2019			2006			2019		
Model	1	2	3	1	2	3	1	2	3	1	2	3
α	−3.892***	−5.596***	−9.051***	−0.488	−0.519	0.182	46.791***	7.426***	8.503***	57.443***	38.752***	36.703***
W*EFF	0.075***	0.079***	0.069***	0.008***	0.008***	0.009***	0.182***	0.113***	0.116***	0.086***	0.086***	0.088***
GIL	−0.559***	−0.582***	−0.544***	−0.037	0.026	−0.035	−0.829**	−0.885***	−0.887***	−1.254***	−0.999**	−1.280***
CMAN	−0.278***	−0.206***	−0.241***	0.072	0.059	0.070	−0.781***	−0.568***	−0.538***	0.395***	0.384***	0.394***
AGL	0.393*		0.474**	−0.591**		−0.693**	1.524***		0.864**	−0.453		−0.500
QCT	1.953***		2.112***	1.940***		1.962***	−4.229***		−3.245***	3.539***		3.575***
EAI	3.161***		3.595***	0.117		0.111	−5.538***		−2.974***	3.840***		4.305***
PDOM		4.240***	4.933***		−0.987	−0.358		46.533***	44.522***		20.082***	21.349***
PFOR		3.828***	3.402**		−1.612	−1.427		35.848***	35.309***		17.487***	17.898***
GOV		4.567	3.852		2.841	2.852		51.538***	50.760***		11.434	12.094
GIL*D	0.362	0.307	0.280	−0.184	−0.180	−0.153	1.146	0.900	1.112	0.518	0.487	0.647
CMAN*D	0.005	−0.096	−0.007	−0.067	−0.022	−0.062	0.598*	0.668*	0.680**	−0.150	−0.156	−0.122
AGL*D	0.260		−0.835	0.377		0.999*	0.740		−0.478	1.531***		0.574
QCT*D	−0.534		−1.731	−3.856***		−3.872***	8.316***		6.042***	0.216		−0.064
EAI*D	−0.572		−2.245*	1.129		0.837	−0.155		−3.574*	−1.294		−1.414
PDOM*D		2.243***	4.913***		−1.145*	−2.817*		3.522***	6.763**		5.887***	3.287
PFOR*D		4.753***	8.158***		4.469**	3.310		12.502***	14.306***		8.280***	6.060*
GOV*D		2.613	6.711		7.509	6.055		7.499	9.698		15.260	12.818

Note(s): The Table presents the results of estimating the equation $\mathrm{EFF}_{\mathrm{i}}^{\mathrm{j}} = \alpha_0 + \gamma \sum_{\mathrm{i}=1}^{\mathrm{N}} \mathrm{w}_{\mathrm{j,i}} \mathrm{EFF}_{\mathrm{i}} + \beta^1 \mathrm{CMAN}_{\mathrm{j}} + \beta^2 \mathrm{QCT}_{\mathrm{j}} + \beta^3 \mathrm{EAS}_{\mathrm{j}} + \beta^4 PDOM_j + \beta^5 PFOR_j + \beta^6 GOV_j + \beta^7 \mathrm{AGL}_{\mathrm{j}} + \beta^8 \mathrm{GIL}_{\mathrm{j}} + D_j(\lambda^1 \mathrm{CMAN}_{\mathrm{j}} + \lambda^2 \mathrm{QCT}_{\mathrm{j}} + \lambda^3 \mathrm{EAS}_{\mathrm{j}} + \lambda^4 PDOM_j + \lambda^5 PFOR_j + \lambda^6 GOV_j + \lambda^7 \mathrm{AGL}_{\mathrm{j}} + \lambda^8 \mathrm{GIL}_{\mathrm{j}}) + \mu_j + \varepsilon_j$

EFF = efficiency, QCERT = quality certification, CMAN = crime management, GIL = Log of graft indexAGL = logof firm′sage, a = intercept,

EA*S* = External auditor involvement,

γ = the spatial autocorrelation coefficient, μ = spatial specific effects, GOV = government ownership, β = non − large firms coefficients, λ = large firms coefficients,

PDOM = private domestic ownership, PFOR = private foreign ownership, $\mathrm{w}_{\mathrm{j,i}}$ = element of the adjacency matrix W.

D = firm size dummy. It takes the value of 1 for large firms and 0 otherwise. Firms are classified into various size categories in the database

***, ** and * are 1, 5 and 10% significant levels respectively

Table A4.
Export effect in the labour and capital efficiencies of firms

	Panel A: Labour efficiency						Panel B: Capital efficiency					
	2006			2019			2006			2019		
	1	2	3	1	2	3	1	2	3	1	2	3
α	−3.784	−5.646	−9.257	−0.333	−0.56804	0.551	46.644***	7.547	8.175	56.26***	38.408	35.781***
W*EFF	0.078***	0.075***	0.069***	0.007***	0.007***	0.008***	0.181***	0.111***	0.111***	0.094***	0.092***	0.086***
GIL	−0.471**	−0.495**	−0.469**	0.187	0.241	0.198	−0.645*	−0.711**	−0.714**	−1.228***	−1.052**	−1.245***
CMAN	−0.271	−0.202***	−0.230***	0.014	0.013	0.017	−0.756	−0.514	−0.489	0.442	0.429	0.439
AGL	0.252		0.243	−0.699***		−0.579*	1.515		0.824**	0.016		−0.363
QCT	2.103***		2.262***	1.462**		1.451**	−3.581***		−2.547**	3.662***		3.599***
EAI	3.407		3.861***	0.531		0.486	−5.692		−2.928***	2.981***		3.495
PDOM		4.271	5.51286		−1.221	−1.294		46.435***	45.112***		20.505***	22.690***
PFOR		4.314***	4.149***		−0.468	−0.838		35.354***	35.499***		18.923	20.236
GOV		4.019	3.636		5.946	5.572		50.590	50.371		14.292*	15.126*
GIL*E	−0.189	−0.302	−0.296	−0.717	−0.816*	−0.729	−0.127	−0.275	−0.171	0.311	0.367	0.308
CMAN*E	−0.094	−0.169	−0.147	0.136	0.149	0.122	0.355**	0.209	0.122	−0.292*	−0.294*	−0.251
AGL*E	1.248***		0.530	0.691**		0.319	1.293		0.341	0.324		0.995
QCT*E	−1.634		−2.212*	−2.855**		−3.033***	6.921**		6.003***	0.710		0.858
EAI*E	−2.856**		−4.081***	−0.530		−0.726	1.564		−2.221	2.283		2.072
PDOM*E		2.408***	2.640		0.264	0.862		4.278***	3.800		3.688***	−2.112
PFOR*E		4.223***	6.101***		2.414	3.318		16.218	14.721***		5.850**	0.608
GOV*E		6.542	8.112		7.601	9.037		14.887	13.720		31.567**	23.895*

Note(s): The Table presents the results of estimating the equation below $\mathrm{EFF}_{\mathrm{i}}^{\mathrm{j}} = \alpha_0 + \gamma \sum_{\mathrm{i}=1}^{\mathrm{N}} \mathrm{w}_{\mathrm{j,i}}\mathrm{EFF}_{\mathrm{i}} + \beta^1\mathrm{CMAN}_{\mathrm{j}} + \beta^2\mathrm{QCT}_{\mathrm{j}} + \beta^3\mathrm{EAS}_{\mathrm{j}} + \beta^4 PDOM_j + \beta^5 PFOR_j + \beta^6 GOV_j +$
$\beta^7\mathrm{AGL}_{\mathrm{j}} + \beta^8\mathrm{GIL}_{\mathrm{j}} + E_j(\lambda^1\mathrm{CMAN}_{\mathrm{j}} + \lambda^2\mathrm{QCT}_{\mathrm{j}} + \lambda^3\mathrm{EAS}_{\mathrm{j}} + \lambda^4 PDOM_j + \lambda^5 PFOR_j + \lambda^6 GOV_j + \lambda^7\mathrm{AGL}_{\mathrm{j}} + \lambda^8\mathrm{GIL}_{\mathrm{j}}) + \mu_j + \varepsilon_j$
EFF = efficiency, QCERT = quality certification, CMAN = crime management, GIL = Log of graft indexAGL = logof firm′ sage, a = intercept, EA*S* = External auditor involvement,
γ = the spatial autocorrelation coefficient, μ = spatial specific effects, GOV = government ownership, β = non − exporting firms coefficients, λ = exporting firms coefficients,
PDOM = private domestic ownership, PFOR = private foreign ownership, $\mathrm{w}_{\mathrm{j,i}}$ = element of the adjacency matrix W.E = exports dummy. It takes the value of 1 for exporting firms and 0 otherwise. Firms are classified into exporting and non-exporting in the database
***, ** and * are 1, 5 and 10% significant levels respectively

Year	Number of countries
2006	25
2007	12
2008	7
2009	44
2010	27
2011	6
2012	3
2013	39
2014	11
2015	9
2016	18
2017	10
2018	7
2019	25
2020	3

Table A5.
Number of countries per each year in the database

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