of emergency random motion is nonlinear, so the AHP-fuzzy comprehensive evaluation algorithm is presented. Experiments show that the AHP-fuzzy comprehensive evaluation algorithm is more accord with people demand for path emergency conditions.

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Impact of Management Practices on Technical Efficiency Based on DEA and Decomposition Analysis

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Abstract
The aim of this study is to examine the impact of management practices on technical efficiency. Previous studies have tackled the determinant of technical efficiency from various angles, but there is a lack of empirical study's framework, which can help us understand the impact of management practices on technical efficiency more insight. First of all, this study analyses determinants of technical efficiency, including foreign capital, management practice, and firm size. Then it builds the DEA, regression analysis and decomposition analysis model, and does the empirical research. The results demonstrate that the management practice is positively correlated with technical efficiency, and management variables explained approximately 23% of the efficiency gap, but the impact of management practices on technical efficiency is correlated with the country information. This paper highlights determinates of technical efficiency for international scholars, and leads the way for further theoretical and empirical studies in the field.
Key words: MANAGEMENT PRACTICES; TECHNICAL EFFICIENCY; EFFICIENCY GAP; DECOMPOSITION ANALYSIS; DATA ENVELOPMENT ANALYSIS

1. Introduction

During the recent decade, the world has witnessed the rapid growth of firms' productivity across countries. The higher is the technical efficiency, the faster is the firms' productivity growth. In the order to improve technical efficiency, which is a key to sustaining growth and alleviating poverty(Oczkowski & Sharma, 2005), it is important to find out the determinants of technical efficiency[1]. So far, this had been widely discussed as an important subject, but has not been fully realized, because there needs more empirical studies.

There is a notable consensus in the literature on the determinants of technical efficiency, but there exists a significant divergence of opinion on what exactly these determinants should be. Previous studies have tackled technical efficiency from various angles, the first determinant of efficiency is the industry, which take one third of the explanatory power. But industry effect only one part of the story, and a substantial unexplained technical efficiency differential still remains, which scholars often label as the fixed effects of size, foreign capital , competition, management practice, firm size, exports, ownership structure, legal form, age of the firm, R&D activity and institutional environment. More recently, the evidence about the size effect in some countries is mixed. The size effect has been shown to be positive or negative. Moreover, conflicts between the demands of the institutional environment and efficiency of internal organizational arrangements have been addressed both theoretically and empirically(Beck & Walgenbach, 2005)[2], for example the 'decoupling' of institutionalized structural elements or management practices from internal procedures (Meyer & Rowan, 1977; Walgenbach, 2001; Westphal & Zajac, 1998, 2001) and the reluctance of organizations with certain technical features to adopt institutionalized structural elements or practices at the beginning of an institutionalization process (Baron, Dobbin, & Jennings, 1986; Fligstein, 1985; Tolbert & Zucker, 1983)[3,4,5,6]. Indeed, there are studies show that R&D activity has had very little positive influence on technical efficiency if any.

Previous studies have tackled the determinant of technical efficiency from various angles, but there is a lack of empirical study's framework, which helps us understand the impact of management practices on technical efficiency more insight. Our research is mainly focused on this.The paper builds the DEA, regression analysis and decomposition analysis model, using country and industry as controlling variables, which are quite common in research studies with a similar purpose to ours, to find the relationship between management practices and technical efficiency out.

2. Determinants of Technical Efficiency

Technical efficiency, which can be measured by comparing observed input coefficient points for an establishment with the input coefficients on the efficiency frontier for the same factor proportions, is often viewed as how closely the establishment attains the lowest possible real cost for the output it produces(Oczkowski & Sharma, 2005)[1]. And its determinants include foreign capital, competition, management practice, firm size and exports. Most other firm characteristics such as ownership structure, legal form, age of the firm and R&D activity have an extremely small explanatory power.

2.1. Foreign capital

The foreign firms' advantage lies in the fact that they have access to superior technologies, modern management techniques, and a well-established marketing network, which can enhance the experience of the workers, modernization of physical capital and product innovation activity that is been positively associated with efficiency(Ajibefun & Daramola, 2003;

Grether, 1999; Pack, 1984)[7,8,9]. So if a firm has foreign capital, which may alter financing, marketing, and technological and managerial practices(Blomström, 1986; Blomström & Persson, 1983; Caves, 1974;) its management practices may be substantially improved, and the firm may move closer to the efficiency frontier [10,11]. Foreign capital is found to have a positive influence on productive efficiency(Grether, 1999)[8]. However, if the motive is to capture the protected market or to take advantage of generous tax incentives offered by the host country, then foreign capital participation may not improve efficiency because there is no real pressure to improve efficiency.

2.2. Management practice

Unlike shareholders, because of informational asymmetries, managers have some freedom to pursue their interests(Martin, 1993)[12]. This make them have the chance to over-invest in some type of input (like capital) as the appropriation of benefits for their own interests(Sena, 2006)[13]. So managers can via some management practices, such as monitoring, targets, incentives and decision-making (Bloom, Genakos, Sadun, & Van Reenen, 2012; Delery & Doty, 1996; Ichinowski, Shaw, & Prennushi, 1997; Rougoor, Trip, Huirne, & Renkema, 1998), to put in a lot of effort at raising the current level of efficiency(Ajibefun & Daramola, 2003; Sena, 2006; Wilson, Hadley, & Asby, 2001)[7,13,14,15,16,17,18]. Small firms' management generally has a detailed overview of production methods and work processes. However, management in large firms focuses on general management(Beck & Walgenbach, 2005)[2]. Management practice is good or not is a significant fact of the technical efficiency of a firm, and bad management practice just like resource misallocation can lower aggregate total factor productivity. Improving the firms' efficiency demands a cost in terms of the firm's management.Managers with more experience and some form of further education, who may have a good management practice, are likely to be less inefficient than those managers with fewer years of experience and lower levels of education(Grether, 1999)[8]. Management techniques, which have been promoted as rational means to increase organizational performance and to secure organizational survival (Beck & Walgenbach, 2005), can help managers to get good management practices. Firms which have adopted quality management techniques are generally perceived to be more innovative and rated higher in terms of managerial competence(Staw & Epstein, 2000)[2,19]. Export expansion brings firms closer to foreign firms, and gives them opportunities to become familiar with better management practices, leading to efficiency improvement.

2.3. Size

The efficiency of a firm depends on its size, but the effect of size on efficiency is ambiguous. On the one hand, technical inefficiency increases as firm size decreases(Wilson, Hadley, Ramsden, & Kaltsas, 1998)[20]. As efficient firms survive and grow, they gain more experience and improve work practices, leading to efficiency improvement. Because of the market power and scale economies, large firms tend to be more efficient than small firms. As an firm's size increases, management becomes less involved in specific technical aspects of production (Beck & Walgenbach, 2005)[2]. One fourth of the explanatory power in efficiency is due to firm size effects. On the other side, in contrast to previous studies, some scholars find that smaller firms are more efficient than larger ones. Besides, the relationship is u-shaped, with the distribution declining afterwards to a certain internal minimum and rising up. So firm size squared is often used in a regression analysis (Bertschek & Entorf, 1996; Neuhäusler, 2012; Sharpe & Nguyen, 1995; Wagner, 2001; Walter, 2012)[21,22,23,24,25].

3. Variables and Data

A firm utilizes various resources (inputs) and produces tangible goods or intangible services (outputs) to satisfy the needs of customers. Accordingly, efficiency is often measured as the ratio of total weighted output to total weighted input. Following previous studies, the indicators selected as input measures include: capital(Shao & Lin, 2002), assets, number of employees (Cooper, Park, & Yu, 2001), number of R&D employees (Shao & Lin, 2002), labor costs l(Shao & Lin, 2002) , operating expenses(Cooper et al., 2001; Kauffmann, Unal, Fernandez, & Keating, 2000), R&D expenditures (Verma & Sinha, 2002) and number of patents owned(SubbaNarasimha, Ahmad, & Mallya, 2003)[26,27,28,29,30].This study adopted the following indicators as input variables: total assets(X1), and number of employees(X2). Based on previous researches, the selected output indicators are: sales, income, value added (Shao & Lin, 2002), financial ratio (SubbaNarasimha et al., 2003), patents and scientific and technological contribution(Oral, Kettani, & Lang, 1991)[26,30,31]. The output variables adopted in this study are as follows: ales (Y). This is used to measure business financial performance.

The data used in the study were provided by the world management survey. The final sample size, after removing cases with missing values, comprises 2910 companies across the world that met the criteria.

DEA was applied to examine the relative efficiency of 2910 companies in transforming input into financial performance. This study performed the data analysis in two stages. The first stage was relative efficiency analysis. Based on the application procedure of DEA described by Golany and Roll (1989), the relative efficiency scores were calculated for 2910 companies.

4. Data Envelopment Analysis

In 1978, Charnes developed a new method named data envelopment analysis (DEA), which can evaluate the relative efficiencies achievable among a group of comparable operations or processe (Cooper, Seiford, & Tone, 2007; Zhu, 2003)[32,33]. As more and more scholars get into this field, DEA is accepted in lots of fields, such as determining organizational, decision-making, business process efficiencies(Cooper, Seiford, & Zhu, 2011), education institution, healthcare, banking and high-tech manufacturing(Wu, Tsai, Cheng, & Lai, 2006)[34,35]. Particularly, DEA can find a way for an inefficient DMU to identify the appropriated measures, which can let it move onto the efficient frontier , to catch up with benchmarking partners by examining their performances. With the development of DEA, the term decision making unit (DMU) has become the accepted expression used for designating the specific operations being studied(Cooper et al., 2007; Zhu, 2003)[32,33].

DEA considers a particular set of DMUs or observations with each DMU possessing a set of input measures and output measures representing its multiple performance metrics, and it can be used to determine the efficiency of a group of decision-making units (DMUs) relative to an envelope (efficient frontier) by optimally weighting inputs and outputs. Many scholars have used DEA as an evaluation technique for performance analysis in their papers, some of them have evaluated the efficiency of high-technology firms, including manpower(Cooper et al., 2001; Despotis, 2005; Thore, Phillips, Ruefli, & Yue, 1996)), cost(Kauffmann et al., 2000; Kozmetsky & Yue, 1998), technology (J. Linton & Cook, 1998; Subba-Narasimha et al., 2003), R&D (J. D. Linton, Walsh, & Morabito, 2002; Oral et al., 1991; Verma & Sinha, 2002)and profits (Shao & Lin, 2002; Verma & Sinha, 2002)[26,28,30,31,36,37,38,39,40,41,42].

4.1. DEA model

DEA, which has been widely used to evaluate the efficiency of a given set of DMUs, is a linear programming-based technique to assess the performance of them. The basic concept underlying DEA is an evaluation of the relative performance of each DMU against a projection onto an empirically derived efficient frontier(J. D. Linton, Morabito, & Yeomans, 2007)[43].Compared with all DMUs, some of DMUs, which performance projects directly onto this efficient frontier, is determined to be relatively efficient, or non-dominated. That means no other DMU's performance is strictly better in either its inputs or its outputs. Unlike subjective scoring approaches, the weighting factors applied to the inputs and outputs are calculated mathematically instead of being determined a priori by the decision-maker.

DEA calculates the relative efficiency of each DMU (company) using the actual observed values of the inputs and outputs. Utilizing the DEA method and the MPI(Färe, Grosskopf, Lindgren, & Roos, 1992), this study examined the relative efficiency of these companies as of 2003, and evaluated the shift of efficiency from 2003 to 2008[44].

For any specific firm k, the Charnes, Cooper and Rhodes (CCR) model (1978) with constant returns to scale (CRS) can be calculated using the following formula to determine its efficiency score (X_i represents the input variables and Y_r represents the output variables)

$$Min\ 1/g_k = \sum_{n=1}^{m} v_i X_{ik} \Big/ \sum_{r=1}^{s} u_r Y_{rk} \qquad (1)$$

Subject to

$$\sum_{n=1}^{m} v_i X_{ij} \Big/ \sum_{r=1}^{s} u_r Y_{rj} \geq 1, j = 1, \cdots, n$$

$$u_r, V_i \geq \varepsilon > 0, r = 1, \cdots, s, i = 1, \cdots, m$$

In the CCR model, it is assumed that an increase in the amount of input consumed will proportionately increase the amount of output produced. Banker, Charnes and Cooper (BCC) (1984) later modified the CCR model and assumed that the amount of output produced is considered to increase more or less than the proportional increase in the inputs. For a specific firm k, the BCC model with variable return to scale (VRS) can be derived using the following formula to obtain scale efficiency:

$$Min\ 1/g_k = \sum_{n=1}^{m} v_i X_{ik} + v_0 \Big/ \sum_{r=1}^{s} u_r Y_{rk} \qquad (2)$$

Subject to

$$\sum_{n=1}^{m} v_i X_{ij} + v_0 \Big/ \sum_{r=1}^{s} u_r Y_{rj} \geq 1, j = 1, \cdots, n$$

$$u_r, V_i \geq \varepsilon > 0, r = 1, \cdots, s, i = 1, \cdots, m$$

The use of the CCR model specification when not all DMUs are operating at their optimum results in measures of technical efficiency, which are confounded by scale efficiencies (SE). The use of the BCC model specification permits the calculation of technical efficiency (TE) without these scale efficiencies' effects. The scale inefficiency can be calculated based on differences between the BCC and the CCR technical efficiency scores. The term technical and scale efficiency (TSE) describes the technical efficiency scores obtained using a CCR model. Meanwhile, pure technical efficiency (PTE) refers to the technical efficiency scores obtained from a BCC model.

During the data analysis phase, a computer program DEAP (version 2.1) developed by Coelli T.J. was adopted. DEAP is a common software that enables researchers to calculate firm relative efficiencies under both constant and various return scales.

4.2. Results

The variable returns-to-scale (VRS) hypothesis was chosen, disentangling technical efficiency(TE), is accountable to management skills, into two different components: pure technical efficiency (PTE) and scale efficiency (SE). Pure technical efficiency, whereas BCC differentiates between technical efficiency and scale efficiency(Golany & Roll, 1989) [45].

Table 1. Technical Efficiency by Nation

Nations	Number of firms	Mean			Min			Max		
		CRSTE	VRSTE	SCALE	CRSTE	VRSTE	SCALE	CRSTE	VRSTE	SCALE
United States	237	0.349	0.549	0.669	0.287	0.348	0.317	0.486	1	0.949
China	334	0.345	0.416	0.852	0.203	0.273	0.446	0.600	1	1
Germany	155	0.349	0.531	0.687	0.259	0.304	0.403	0.985	1	1
France	301	0.379	0.488	0.805	0.293	0.331	0.334	0.928	1	1
Great Britain	687	0.361	0.457	0.819	0.131	0.263	0.234	1	1	1
Northern Ireland	95	0.315	0.425	0.761	0.099	0.294	0.261	0.459	0.787	1
Greece	171	0.334	0.435	0.811	0.254	0.287	0.330	0.693	1	1
Republic of Ireland	89	0.327	0.431	0.785	0.087	0.292	0.198	0.751	1	1
Italy	169	0.349	0.460	0.788	0.284	0.301	0.436	0.528	0.766	1
Japan	93	0.330	0.517	0.675	0.284	0.293	0.403	0.386	0.836	0.999
Poland	190	0.346	0.403	0.872	0.265	0.296	0.518	1	1	1
Portugal	162	0.337	0.409	0.858	0.276	0.292	0.330	0.501	1	1
Sweden	227	0.358	0.496	0.753	0.285	0.293	0.399	0.563	0.811	1

From Table 1 we can find following, the efficient firms are in the United States, China, Germany, France, Great Britain, Northern Ireland, Greece, Republic of Ireland, Italy, Poland, Portugal and Sweden. Specially, Great Britain and Poland have efficiency score of 1.00 in CRSTE, PTE and SE. France has the highest efficiency score in the average of CRSTE, and Canada and Brazil have the highest efficiency score in the average of VRSTE and SCALE, respectively. However, there are only one or two firms in Canada and Brazil in our sample. If we do not take them, which country have less than 80 firms in our sample, into consider, it is obviously that the United States and Poland have the highest efficiency score in the average of VRSTE and SE, respectively. The companies with efficiency score of 1 are located on the efficiency frontier. Table 1 demonstrates that most of firms are less efficiency, and the average score of CRSTE, VRSTE and SCALE are around 0.3, 0.5 and 0.7, respectively.

We first report the DEA results and discuss the efficiency in some dimensions. Then, the efficiency scores are pooled together and used as dependent variables in regression analysis. The OLS method is used for the simple linear model.

5. Limited Dependent Variable Model Estimates

Regression analysis is used to investigate the impact of management practices on technical efficiency. The efficiency scores are pooled together and used as dependent variables in regression analysis and the scores of management practice, foreign capital and firm size used as independent variables, which have been found impacting determinants of technical efficiency. Following extensive literature on the technical efficiency, we use several control variables, such as industry code and country, which can somehow reflect the firms' competition pressure. Less protection and greater exposure of firms to competition in some industries or countries , which make both managers and workers may decide for higher effort to increase productivity so to minimize the firm's bankruptcy risks(Sena, 2006), is viewed as a means of learning superior production and management techniques (Ajibefun & Daramola, 2003; Oczkowski & Sharma, 2005)[1,7,13]. Foreign capital is represented by whether a firm is a foreign MNE or a domestic MNE. Firm size is represented by the No. of firm employees. Regression results are shown in Table 2.

Table 2. The impact of management practices on technical efficiency

	VRSTE	Omitted Variables Test
Number of obs	2910	
Adj R-squared	0.5087	0.5090
Coef.		
Constant	0.6308***	0.5356***
Management	0.01657***	0.0138***
Firm size	-0.14251***	-0.1077*
Foreign captiacl	0.2323***	0.0191***
Firm size-squared	0.0153***	0.0117**
dea-squared		0.1917
Std. Err.		
Constant	0.0743	0.1747
Management	0.0030	0.0050
Firm size	0.0229	0.0603
Foreign captiacl	0.0038	0.0065
Firm size-squared	0.0017	0.0058
dea-squared		0.2486

Note: *, **, *** represents significance at the 10%, 5%, and 1% level, respectively.

Regression results in Table 2 show that management practices have positive effects on VRSTE. These effects are all statistically significant at the 1% level. Two results stand out. On one hand, management practices appear to be positively correlated with VRSTE. 1% increase in management practices brings up technical efficiency by 0.01657 percentage points. Although this result is obvious prior to estimation, no empirical study have been done yet. It is interpretable in that the higher the ratio of the management practices, the better the work condition for employees, and as a result, more efficient the firm could be. On the other hand, given that the management – VRSTE relationship is to a large extent determined by firm size, foreign capital ,and that firm size-squared. It can be found that VRSTE decreases with firmsize, asmeasured by the log number of employees. This fact becomes clearer when looking at the squared size effect, which shows a positive coefficient. This means that there is a u-shaped relationship between firm size and VRSTE, with the distribution having an internal minimum point—or in other words, the large as well as the small firms in the sample are more efficient than medium-sized companies. Digging a little deeper into these effects, a significantly positive correlation between foreign capital and VRSTE can be found (0.2323***).

In the order to justify the robustness of our result, we use the2007 and 2009's data to do the DEA efficiency estimates and regression analysis, respectively. The results are shown in Table 3. The results in Table3 show that the robustness of our result is good.

6. Decomposition Analysis

In order to examine the determinants of the efficiency gap between various kinds of firms by whether they have foreign capital or not, we used the method of Oaxacae - Blinder decomposition (Blinder, 1973; Oaxaca, 1973) using Stata version 12.1[46,47]. Since the efficiency gap reflects the differences in the group means of the outcome, it lends itself to the decomposition analysis of the group means of determinants. This methodology decomposes the observed group difference in outcome into two main components: the disparity associated with the differences in determinants and the disparity associated with the differential response by groups to those determinants(Powell, Wada, Krauss, & Wang, 2012)[48].

Table 3. Robust analysis results

	2007	Omitted Variables Test	2008	Omitted Variables Test
Number of obs	1201		1027	
Adj R-squared	0.4421	0.4429	0.5657	0.4429
Coef.				
Constant	1.62305***	1.9636***	1.22209***	1.7600***
Management	0.01404***	0.02424**	0.01396**	0.01982**
Firm size	-0.18928***	-0.3402**	-0.32468***	-0.5019***
Foreign capital	0.01684	0.0271**		
Firm size-squared	0.01461***	0.02628**	0.02796***	0.0432**
dea-squared		0.5033		-0.4383
Std. Err.				
Constant	0.5186	0.5680	0.0873	0.5680
Management	0.0044	0.0091	0.0053	0.0063
Firm size	0.0145	0.1246	0.0298	0.1152
Foreign capital	0.0108	0.01326		
Firm size-squared	0.0012	0.0097	0.00253	0.0100
dea-squared		0.3950		0.3553

Note: *, **, *** represents significance at the 10%, 5%, and 1% level, respectively.

This methodology is often used to study labor-market outcomes by two groups (sex, race, and so on), and divides the wage differential between two groups into "explained" and "unexplained" part. Education and work experience are always used as the determinants in the "explained" part. The "unexplained" part also subsumes the effects of group differences in unobserved predictors (Weichselbaumer & Winter-Ebmer, 2005)[49]. This method can also be useful in other fields, such as health inequalities, public health(Chung, Lim, & Lee, 2010;), cross-country differences in obesity(Font, Fabbri, & Gil, 2010), body mass (Powell et al., 2012), non-firm income[48,50,51]. In general, the technique can be employed to study group differences in any (continuous and unbounded) outcome variable.

The Oaxacae Blinder decomposition was implemented in the following form:

$$\overline{VRSTE}_F - \overline{VRSTE}_N = \overline{X}'_F \hat{\beta}_F - \overline{X}'_N \hat{\beta}_N = \left(\overline{X}'_F - \overline{X}'_N\right)\hat{\beta} + \overline{X}'\left(\hat{\beta}_F - \hat{\beta}_N\right) \quad (3)$$

Where indices F and N indicate foreign capital and native capital, VRSTEF and VRSTEN were the mean VRSTE for the respective firms, X was the vector containing the means of the covariates, and $\hat{\beta}$ was the vector containing a weighted average of the estimated coefficients for foreign, $\hat{\beta}_F$, and for native, $\hat{\beta}_N$.

The Oaxacae Blinder decomposition decomposes the difference in VRSTE between two groups into those due to the group differences in means of explanatory variables and those due to the group differences in the estimated coefficients.

$$\overline{VRSTE}_F - \overline{VRSTE}_N = \left(\overline{X}'_F - \overline{X}'_N\right)\hat{\beta}^* + \overline{X}'_F\left(\hat{\beta}_F - \hat{\beta}_N\right) + \left(\overline{X}'_F - \overline{X}'_N\right)\left(\hat{\beta}_F - \hat{\beta}_N\right) \quad (4)$$

This is a 'threefold' decomposition. The first component amounts to the part of the differential that is due to group differences in the predictors, that is called 'endowment effect'. The second component measures the contribution of differences in the coefficients. The last component is an interaction term accounting for the fact that differences in endowment and coefficients exist simultaneously between two groups.

Not only is the total decomposition of the outcome differential into an explained part of interst, but also the detailed contributions of the single predictors or sets of predictors are subject to investigation. In the order to evaluate how much of the efficience gap is due to differences in management and how much is due to differences in firm size, we followed the method proposed by Yun(2005)which used to do the detailed decomposition.

Our model specification began with a base model of firm size covariates (Model 1) and then sequentially added management scores (Model 2) and country (Model 3), to assess to what extent the efficiency gaps can be explained by these factors.

Summary statistics and sample sizes are presented in Table 4.

Table 4. Overview of the variables and summary statistics

	Number of obs	Outcome measure	Income measure	
		Efficiency	Management	Firm Size
Foreign capital	1333			
Minimum		0.27	1	0
Maximum		1	4.94	9.61
Mean		0.4401	2.9235	5.7323
Std. Deviation		0.1145	0.6690	1.1943
Native capital	1577			
Minimum		0.26	1.31	1.1
Maximum		1	4.94	11.06
Mean		0.4816	3.2425	5.8327
Std. Deviation		0.1191	0.5987	1.0942

6.1. 'Threefold' Decomposition

Oaxaca first estimates two groups regression models and then perform the decomposition. As shown in table5, all estimated coefficients are statistically significant at the one percent level, except the interaction's coefficient. The mean of VRSTE is 0.4816 for foreign capital and 0.4401 for native capital, yielding a gap of 0.0415. The "Endowments" part reflects the increase of 0.0138 indicates that differences in firm size and management account for 33.25% of the gap. This also means 0.0138 increase in native capital firms' efficience, if native capital firms had the same firm size and management skill as foreign capital firms. The second term quantifies the change in native capital firms' efficience when applying foreign capital firms' coefficience, which means the degree of influence between the firm size(management skill) and efficiency, to native capital firms' variables. It accounts 65.54% of the total difference, and indicates that it is very important for the native capital firms to make thire management skill and scale performance more helpful, if they want to reduce the gap. The third part is the interaction term that measures the simultaneous effect of differences in endowments and coefficients. In our study, the interaction, which is only 0.0005(1.2% of the total difference) and not significant, does not seem to matter much.

Table 5. Threefold decomposition results

	foreign capital	native capital
Number of obs	1333	1577
F value	184.10***	280.08***
R-squared	0.2168	0.2625
Adj R-squared	0.2156	0.2615
Coef.		
Constant	0.3230***	0.0977***
Management	0.0335***	0.0274***
Firm size	0.3649***	-0.3402***
Std. Err.		
Constant	0.0165	0.0180
Management	0.0043	0.0044
Firm size	0.0024	0.0024
VRSTE	Coef	Std. Err.
Differential		
foreign capital	0.4816***	0.0175
native capital	0.4401***	0.0219
difference	0.0415***	0.0280
Decompsition		
Endowments	0.0138***(33.25%)	0.0028
Coefficients	0.0272***(65.54%)	0.0040
Interaction	0.0005(1.20%)	0.0020

Note: *, **, *** represents significance at the 10%, 5%, and 1% level, respectively.

6.2. Detailed Decomposition

The respective contributions of the firm size, management and country factors to the “explained” part of the VRSTE gaps are show in table6. As shown in table6, all estimated coefficients are statistically significant at the five percent level or better. The results are presented for three models that sequentially included each set of covariates: Model 1 was the base model with firm size; Model 2 added the management covariates to Model 1; and, Model 3 was the full model that added thecountry factors to Model 2.

The results in Table 6 show that the base model (Model 1) that included only the firm size explained roughly 11% of the VRSTE gaps between two groups. Once management variables was included, the contribution of thefirm size fell to 10%. In particular, management variables explained approximately 23% (in model 2)of the efficiency gap but explained substantially less (just 14% in Model 3). This means the impact of management practices on technical efficiency is correlated with the country information. In the full model, Model 3, the country factor explained 22.17% of the efficiency gaps. The total explained percentage is 11.33%, 33.97%, 48.44%, in Model 1, Model 2, Model 3, respectively.

Table 6.detailed decomposition results

Variables	Foreign - native capital firms (VRSTE=0.0415 units)								
	Model1			Model2			Model3		
	Coef	S.E.	Perc	Coef	S.E.	Perc	Coef	S.E.	Perc
Firm size	0.0047^{**}	0.0020	11.33%	0.0044^{**}	0.0019	10.60%	0.0047^{**}	0.0020	11.33%
Management				0.0097^{***}	0.0013	23.37%	0.0062^{***}	0.0012	14.94%
Country							0.0092^{***}	0.0020	22.17%
Total	0.0047^{**}	0.0020	11.33%	0.0141^{***}	0.0032	33.97%	0.0201^{***}	0.0031	48.44%

Note: *, **, *** represents significance at the 10%, 5%, and 1% level, respectively.

7. Summary and conclusions

Our research design has been focused on managerial practice from the employer perspective rather than the worker perspective. It has been proved that the management practice is positively correlated with technical efficiency, and they are all statistically significant. In particular, management variables have been explained approximately 23% of the efficiency gap, but the impact of management practices on technical efficiency has been correlated with the country information. Our investigation on the impact of management practice has been thus inconclusive, partly because of the method’s problems but mainly because of the data we used. Beyond that, comparative static and even dynamic studies of management practice have been required. To obtain more significant parameter estimates, the entire data-set for the three-digit industries could be utilized by forming a DEA frontier for each industry (three-digit or two-digit) and then by pooling the efficiency scores from all industries to perform a regression analysis as in this study(Zheng, Liu, & Bigsten, 1998)[52]. As an exploratory study in an area yet to be fully developed, this paper highlights determinates of technical efficiency for international scholars, and leads the way for further theoretical and empirical studies in the field.

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