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ASSESSING THE RELATIVE FINANCIAL EFFICIENCY OF SMES IN THE NORTHERN CORRIDOR ECONOMIC REGION

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ABSTRACT

ASSESSING THE RELATIVE FINANCIAL EFFICIENCY OF SMES IN THE NORTHERN CORRIDOR ECONOMIC REGION[1]

Given the important role of SMEs as an endogenous growth factor in local economy, ensuring a strong and competitive development for this industry segment has become a key concern in making the Northern Corridor Economic Region (NCER) a success. This paper gauges the operating efficiency of SMEs in NCER in channelling financial resources to revenue and profit. Data Envelopment Analysis (DEA) is used to analyse 1047 SMEs in Kedah, Penang and Perak for the financial year 2007. DEA shows that only 20 SMEs scored 100% efficiency, and they are mostly from Kedah and Perak, Most of them are from Wholesale and Retail Trade and Restaurant and Hotels, follows by Financing Insurance, Real Estate, Investment and Business Services, and Manufacturing. This sectoral representation for the efficient SMEs is consistent with the distribution in NCER population. From our DEA analyses, we conclude three findings: first, financial efficiency is not related to company size; second, oversize in capital (inputs) is more critical than profit (output) generation in determining relative efficiency; third, the distribution of financial efficiency is not balance across the three states in NCER. The first and third points are consistent with the Korean case reported in Yang (2006).

KEYWORDS: SME, Efficiency, Finance, DEA, NCER

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1. Introduction

Small and medium enterprises (SMEs) have been widely recognized as the backbone of Malaysian economic due to their contribution in promoting endogenous growth for industry expansion and development (Saleh and Ndubisi, 2006). For their role in providing tax revenue, output, employment and product diversity, this industry segment has started to gained attention among policymakers, large corporations and the research community. However, with the competitive business environment under globalization and deregulation, SMEs are contending with a number of challenges. Among the major constraints are limited access to capital financing, low degree of professionalism, difficulties in recruiting qualified personnel, dependency on clients and suppliers, heavy regulatory burdens, and the absence of economies of scale, among others (see Burns, 2001; and Wang, 2003). Some of these are also challenges to Malaysian SMEs as a whole (see Moha, 1999; SMIDEC, 2004; and Saleh and Ndubisi, 2006) but the relative importance of these factors is not well covered in the literature. Policymakers often have to devise policies with little or incomplete information about these factors and that deter the development of SMEs.

The launch of the Northern Corridor Economic Region (NCER) that span from 2007 to 2025 represent the direction of the Malaysian government to accelerate economic growth in the north of Peninsular Malaysia. NCER encompasses the states of Kedah, Penang, Perak and Perlis. The NCER programme not only aims to maximise economic potential and development of the northern region, it also carry the mission to gear the region towards higher value-add and knowledge-based economic structure, emphasizing on the transformation and expansion of the agricultural, manufacturing, tourism and logistics sectors in the region. In this context, SMEs can act as an endogenous mechanism in generating domestic-led investment. The development of SMEs not only is important to provide a catalyst to nurture growth opportunities in the region, but also helping to evade too much dependency on foreign direct investment. In this regards, ensuring a sound and competitive development for SMEs in the northern region has become a key concern for the policymakers. To make NCER a success, it is essential thus to identify the strengths and weaknesses of SMEs in the region.

Finance is one of the key factors to a successful business. SME not only need to have a sound and solid financial structure, they also need to understand the source of capital financing that specifically matched to their needs. There is still a large gap remain in our knowledge about of SME's efficiency in utilizing financial resources. The present study aims to gauge the performance of SMEs with respect to their relative operating efficiency in channeling financial resources – we shall call it financial efficiency henceforth. In this study, we aim to answer three simple questions. First, are the better capitalized SMEs more efficient in having higher profitability? This issue is critical since a financially inefficient SME; regardless how large is the company size or how efficient is its technical efficiency in production, is unlikely to compete and survive, grow and generate employment. Second, which of the financial inputs or outputs do SMEs in NCER need to focus on? This issue is very relevant to the SMEs as well as to the authority in monitoring and supervising the development of SMEs in the region. Third, across states and across sector, are the SMEs in NCER performing comparably well in terms of financial efficiency? This issue is more related to policy makers in deciding and fine-tuning the allocation of SME funding across different states and various sectors. To answer the above questions, this paper employed a frontier efficiency technique called Data Envelopment Analysis (DEA) to analyze a balance sample of 1047 SMEs in NCER for the financial year 2007. This technique has been applied to study SME efficiency quite recently. More on this technique is discussed in section 2 and section 3 after this.

The rest of this paper is organized as follows: section 2 provide a brief literature review, section 3 discuss the methodology, and section 4 reports the process of data compilation. The DEA results are discussed in section 5, and finally section 6 offers the concluding remark.

2. Literature Review

From our knowledge, Tan and Batra (2003) and Yang (2006) are the only two studies applied frontier efficiency techniques in research on efficiency issues in SMEs. Tan and Batra (2003) examine how skills, technology and productivity in manufacturing SMEs vary across different firm size. They cover six emerging countries, which comprises Colombia, Guatemala, Indonesia, Malaysia, Mexico and Taiwan. The sample from each country is not consistent in size and year; the data for Colombia, Indonesia and Mexico are for year 1992; the data for Guatemala, Malaysia and Taiwan are for year 1999, 1994 and 1986, respectively. The sample size also varies, from the smallest 300 firms for Indonesia and Guatemala, to 56,047 firms for Taiwan. The paper apply a parametric stochastic production frontier (SPF) model, which is one of the five major frontier efficiency techniques, on a list of variables, including various measures for firms' financial status, production process and workers' quality. Basically Tan and Batra (2003) find technical efficiency rises with firm size, but small firms are not inherently inefficient. They also report a common set of factors play an important role in determining the efficiency levels of SMEs across the six emerging markets. These include education and training of workers, investment in new technology, automation, and quality control.

Yang (2006), on the other hand, examines the issue of production efficiency across capital and non-capital regions for the case of Korean SMEs. The paper analyzes the technical efficient and resource utilization of 267 Korean SMEs that received government funding, for the sample year 2000-2002. In their study, another frontier efficiency technique - DEA is used. DEA is basically a nonparametric input/output analysis. The inputs used in the study are companies' capital, fixed assets, number of staff members, fund raising (sum of finances), and other policy funds (sum of other operating funds); while two outputs are included; business profit and total sales. The choice of inputs and outputs shows that Yang (2006) basically focuses on SMEs' financial efficiency. From their results, they conclude that large SMEs are relatively more efficient but the efficiency level is not balance across various regions; where the SMEs in the capital area are relatively more efficient. Other important findings are related to channeling of government funds.

3. Methodology

The concept and application of frontier efficiency techniques can be dated back to the seminal work of Farrell (1957). According to Berger and Humphrey (1997), a frontier efficiency technique, which is essentially a relative efficiency benchmarking, provides an overall, objectively determined, numerical efficiency value (x-efficiency) and ranking of the production units that is not otherwise available. In the area of frontier efficiency analysis, there are two different methodologies - parametric and non-parametric methods. FØrsund *et al.* (1980) provide an extensive discussion of the two approaches.

In this study a DEA frontier analysis is chosen to benchmark the relative efficiency of the SMEs in the NCER. DEA is a non-parametric frontier analysis, developed by Charnes et al. (1978). Among the five frontier techniques, DEA is chosen as this approach is comparatively robust (Seiford and Thrall, 1990) and popular (Cooper et al., 2004).[‡] DEA does not require an explicit specification of the underlying input/output production process. This relaxes many restrictive parametric assumptions and avoids limitations in traditional efficiency measurement approaches.

DEA is a unit free technique that analyse multiple input and multiple output process. This model has been popular in analysing firm level efficiency and it has been widely used in rating commercial banks, non-profit organizations, government agencies, universities, hospitals, and airports. Only recently this model has been extended to measure country level efficiency, see Taskin and Zaim (2001), Ali and Nakosteen (2005), Tan and Hooy (2007) and Tan et al. (2008). For the area of SME, there are only two applications found, i.e. Tan and Batra (2003) and Yang (2006).

DEA essentially forms a frontier using the relatively efficient SMEs. The process of DEA benchmarking is to construct a nonparametric envelope frontier over the data points such that all observed SMEs lie on or below the frontier. DEA then determine which particular SME operates on the efficiency frontier and which unit does not. All the SMEs that lie on the frontier are known as the reference peers. DEA then establishes a relative scoring system leads by the benchmark efficiency score of unity. In other word, DEA identifies a group of optimally performing SMEs that are defined as efficient SMEs and assigns them a score of unity. These efficienct SMEs are then used to create an efficient frontier or "data envelope" which all SMEs are to be compared against. To put things into framework, the relative efficiency score E_K for *k*-SMEs, or so-called decision making units (DMU), is given as follows:

[‡] Besides DEA, another nonparametric frontier is Free Disposal Hull (FDH) suggested by Deprins et al. (1984). FDH is a special case of the DEA model that has relatively little structure on the specification of the best-practice frontier. The other three frontier approaches are parametric based that account for random error, comprises of SFA by Aigner et al. (1977), Meeusen and van den Broeck (1977) and Battese and Corra (1977); the thick frontier approach (TFA) by Berger and Humphrey (1991), and the distribution-free approach (DFA) by Berger (1993).

$$E_K = \frac{\sum_{j=1}^{n} V_{jk} Y_{jk}}{\sum_{i=1}^{m} U_{ik} X_{ik}} \quad (1)$$

where Y_{jk} and X_{ik} denote the *j*-th k-output and *i*-th k-input respectively for *k*-SMEs (the k-th DMU). V_{jk} and U_{ik} are the weight placed on the *j*-th k-output and *i*-th k-input respectively and $\sum_{j=1}^{n} V_{jk} = \sum_{i=1}^{m} U_{ik}$ for all *k* (*k*=1,2,...9). This paper applied the basic constant returns-to-scale DEA model. The weights are assumed to be uniform across the inputs and outputs. Transforming the model into a linear fractional programming formula, the focus is to solve the normalized E_K, that is e_K:

$$\text{Maximizing } e_K = \sum_{j=1}^{n} V_{jk} Y_{jk} \quad (2)$$

Subject to the constraints of:

- $\sum_{i=1}^{m} U_{ik} X_{ik} = 1$
- $\sum_{j=1}^{n} V_{jk} Y_{jk} - \sum_{i=1}^{m} U_{ik} X_{ik} \leq 0$
- $V_{jk} \geq 0$, j= 1,2,...,n
- $U_{ik} \geq 0$, i= 1,2,...,m
- $\sum_{j=1}^{n} V_{jk} = \sum_{i=1}^{m} U_{ik}$

As a whole, the optimization procedure in DEA serves to ensure that the particular SME being evaluated is given the highest score possible by maximizing its relative efficiency ratio, at the same time maintaining equity for all other SMEs (see Cooper, Seiford and Tone, 2000). The most efficient SMEs are assigned a value of unity (100%); this is the highest score that none of the other SMEs can exceed, the rest of the lesser performers are downwardly ranked according to their lowered efficiencies.

Despite examine the relative performance of SMEs, which is reported in section 5.2, the DEA model also allows us to look at the strengths of the identified efficient SME(s) as well as drilling into the weak points of the inefficient SME(s). As DEA benchmarking process trace out how far the inefficient SME(s) are situated from the efficient frontier at the nearest point, i.e. the group of the reference peers, it allows us to gain three addition information on the benchmarking process. One, we can trace out the frequency of the group of reference peers for each SME to see which of the reference peer appears to be the most frequently referred efficient SME, in other word, the universal best efficient SME. Second, as the process is done on multiple-input-output framework, we can also see relatively which of the input and output are used the most frequently in benchmarking the efficient reference peer(s) to each SME. By this, we can understand the strength(s) of the efficient SME. Third, the slack variables in the linear programming process can be referred as the indicators for

future improvement. This is the target improvements for the inefficient SME, benchmarking to its groups of reference peers, so that the inefficient SME can achieves at least as efficient as the reference peer(s). In terms of input, the percentage to gain in the target improvements refers to the percentage of input to be reduce, while in terms of output, the percentage to gain suggest the ideal of additional output achieve based on the actual inputs. The first two analyses are focus on the group of reference peers. We report them in section 5.3. The result of the third analysis on the inefficient SMEs is reported in section 5.4.

4. Data Compilation

The data of our study is sourced from *"Suruhanjaya Syarikat Malaysia"* (SSR) *–Companies Commission of Malaysia*. The data covered four states in the NCER, comprise of Kedah, Penang, Perak and Perlis. The inputs and outputs used in our study are from balance sheet and income statement for the financial year 2007. However, SSM database only record basic accounting items of the two accounts, so we have a constraint in data selection; we have to choose the inputs and outputs based on its availability on SSM data source.

Following Yang (2006), we decided to use fixed asset, current asset and paid up capital as financial inputs, and revenue and profit before tax as financial outputs. However, as SSM do not have record of company's staff numbers (employees), and break down details of the two accounts, we are not following Yang (2006) exactly.

Based on the original balance sheet account we received from SSR for the financial year 2007, there are 16,988 companies in NCER. However, a small number of companies do not have a complete record of certain important information, so we have to do some screening. First, we take out companies without any information on the originality of the business state code (chrbusinessstatecode), as these companies cannot be allocated to any four of the NCER states. As a result, we take out 23 companies and left 16,965 companies. The screening process is reported in Table 1.

Table 1 Sample Screening Process

Screening Stages	Kedah	Penang	Perak	Perlis	Total
Original SSM Record	-	-	-	-	16988
First Screen (by state code)	-	-	-	-	23
After First Screen	2958	8235	5562	210	16965
Second Screen (by post code)	22	58	125	5	210
After Second Screen	2936	8177	5437	205	16755
Third Screen (by business type)	151	349	477	7	984
After Third Screen	2785	7828	4960	198	15771

We then screen the remaining companies by their state origin based on their business post code (vchbusinesspostcode). In this round, again we have to disburse a total number of 210 companies that do not have a business post code, which resulted only 16,755 companies left. Table 2 provides a brief description on these 16,755 companies based on their size, measured by two different proxies, i.e. total asset and paid up capital. The purpose to use two proxies for size is to check which of these two proxies provide a better company distribution. From Table 2, Penang has the largest number of registered companies, a total of 8,177 units, follows by Perak, Kedah and Perlis, with 5,437 units, 2,936 units and 205 units, respectively. Generally, we can see that the distribution of the companies in NCER is quite normal. The center of the distribution is category 4 (< 10 million but ≥ 1 million) under total asset but it is category 5 (< 1 million but ≥ 100,000) under paid up capital, except for Perlis which centered at category 5 for both size proxies. This shows that most companies are medium in size, no matter how you measure size. However, under paid up capital there is a significant number of very small companies (in category 8) across the four states; this distorts the bell shape normal distribution. For this reason, we think total asset is a better proxy for size in NCER. The following analysis thus is based on total asset as a proxy for company size.

In the third round, we screen again the 16,755 companies by the availability of their business code (vchbusinesscode) that identifies the sector which they involved in. In this round, there are 984 companies without a business code or business descriptive in Malay texts (vchbusinessdescmalay).[§] The remaining sample, which is a total of 15,771 companies, is tabulated in Table 3 by the type of business they involved in. From Table 3, obviously *Wholesale and Retail Trade and Restaurant and Hotels* is the largest sector in NCER; representing around 35% of the number of registered companies available in the four states. This is follows by *Financing Insurance, Real Estate, Investment and Business Services* and *Manufacturing*, respectively, representing about 20% and 16% of the company numbers in the four states. Given the nature of their business, *Electricity, Gas and Water* and *Mining and Quarrying* have the smallest number of companies in the four states. In Perlis additionally, *Agriculture, Hunting, Forestry and Fishing* is also one of the smallest sectors, which only consists of two registered companies.

Due to the small number of registered companies in Perlis (only 198 companies), we decide to exclude Perlis from our DEA analysis. Also, we have to follow the conventional wisdom in sectoral analysis to exclude investment companies under *Financing Insurance, Real Estate, Investment and Business Services*. One simple reason is the business nature of investment companies is very much different with an operational type of business and they rely a lot on liability rather asset to generate revenue and profit.

Our next step is to select a sample of SMEs from each three states to get a balance representative for NCER. We decided to carry out the sample selection by company size (total asset). We extract out the top largest 100 companies from four categories: category 3 (inclusive of category 1 and category 2), category 4, category 5 and category 6. With that, we have a total of 400 companies for each state. These 400 companies are representatives of four different size levels of SMEs in each state. We assigned a company code for each of the SMEs following the state code used in SSM database: K for Kedah, P for Penang, and A for Perak. A

[§] The SSM database is in the Malay text, the official language in Malaysia.

numerical number is then assigned following the ranking by size. For example, the largest SME in Perak is A001 while the smallest is A400.

We do a pre-test on the 1200 sample and find that DEA linear programming cannot accommodate the cases with a combination of zero revenue and negative profit. To carry on the DEA analysis, we have no choice but to do another round of screening and only left with 315, 354 and 378 companies for Kedah, Penang and Perak, respectively, with a full sample of 1047 companies. We carry on our full DEA analysis on each state separately as well as the full sample of 1047 companies. The results are reported in the next section.

5. DEA Analysis and Results Discussion

5.1 Descriptive Statistics and Correlation Matrix

We report the descriptive statistics of our final sample in Table 4. In average, the SMEs in Penang are larger in size and profitability relative to those in Perak and in Kedah; regardless we measure size is fixed asset, current assets or paid up capital; and regardless profitability is measured in revenue or profit before tax. The mean values of all the inputs and outputs for SMEs in Penang are well above those of the same measure for the full sample. For example, the average fixed asset for SMEs in Penang is RM 38,936,976 or 38.9 million, but for those in Kedah and in Perak, the averages are RM 21.8 million and RM 38.8 million, respectively. The average for the full sample size is only RM 33.1 million. The size of SMEs in Perak is larger than the SMEs in Kedah but they are mostly below the average size of the full sample. This pattern remains the same for the values of median, i.e. the values for SMEs in Penang dominate those in Kedah and in Perak, as well as the average size of the full sample.

Nevertheless, the standard deviation of fixed asset for SMEs in Penang are smaller than the SMEs in Perak but still oversize those in Kedah, but for current asset, the variation for SMEs in Penang is the largest, follows by the SMEs in Perak and Kedah. For paid up capital, the SMEs in Kedah have the largest variation, follows by SMEs in Penang and in Perak. The standard deviation of revenue and profit for SMEs in Penang are also higher than those in Perak and in Kedah, and even the full sample. The largest companies in NCER can go beyond RM 4 billion in fixed asset, and has current asset and paid up capital beyond RM 1 billion and RM 0.7 billion, respectively. In terms of revenue and profit, the largest values are also from SMEs in Penang, which are RM 4 billion and RM 630 million, respectively.

An important requirement for DEA to perform well is that we need to ensure all the input and output sets of variables are free from multicollinearity problem. This is because highly correlated inputs or outputs capture similar information set underlying the efficiency process. Here we refer to pairwise correlation coefficient to check for multicollinearity problem. We report the correlation matrix of the five variables in Table 5. Generally, we can conclude that both input and output set of variables are free from multicollinearity problem as nearly all the pairwise correlation coefficient are below the conventional threshold of high correlation, 0.7. Only two exception cases are detected: between fixed asset and paid up capital for Penang (0.8049), and between revenue and profit for Perak (0.7999). These two cases are not really a serious concern as the correlation values are just slightly beyond the threshold. Moreover, when we combine them for the full

sample in panel 4, the pairwise correlation coefficients among all the variables drop to a low level below 0.5. Thus we can proceed to DEA analysis safely.

Table 2 Number of Company Tabulated by Size

State	Kedah		Penang		Perak		Perlis	
Size Measure (in ringgit)	Total Asset	Paid Up Capital	Total Asset	Paid Up Capital	Total Asset	Paid Up Capital	Total Asset	Paid Up Capital
Category 1: ≥ 1billion	3	1	8	0	6	0	1	1
Category 2: < 1billion but ≥ 100 million	55	10	184	39	64	22	1	0
Category 3: < 1billion but ≥ 10 million	389	105	1094	315	636	127	15	3
Category 4: < 10 million but ≥ 1 million	1381	490	3586	1350	2566	961	85	33
Category 5: < 1 million but ≥ 100,000	1027	1619	3038	4286	1983	2972	95	124
Category 6: < 100,000 but ≥ 10,000	75	351	245	1072	171	790	8	21
Category 7: < 10,000 but ≥ 1,000	4	27	13	75	8	44	0	1
Category 8: < 1,000 but ≥ 0	2	333	9	1040	1	520	0	22
Category 9: < 0*	0	0	0	0	2	1	0	0
Total	2936	2936	8177	8177	5437	5437	205	205

Note: * The existence of Category 9 (company size in negative value) might be due to record error.

Table 3 Number of Company Tabulated by Business Type

Business Code	Original Category	Kedah		Penang		Perak		Perlis	
0	Unclear Record	1	0.04%	1	0.01%	0	0.00%	0	0.00%
1	Dormant	28	1.01%	57	0.73%	156	3.15%	2	1.01%
111210-122000	Agriculture, Hunting, Forestry and Fishing	76	2.73%	114	1.46%	276	5.56%	2	1.01%
200000-290140	Mining and Quarrying	16	0.57%	22	0.28%	72	1.45%	2	1.01%
300000-399730	Manufacturing	531	19.07%	1508	19.26%	826	16.65%	22	11.11%
420000	Electricity, Gas and Water	10	0.36%	23	0.29%	14	0.28%	1	0.51%
500000-553000	Construction	280	10.05%	559	7.14%	432	8.71%	30	15.15%
610000-646400	Wholesale and Retail Trade and Restaurant and Hotels	1003	36.01%	2848	36.38%	1713	34.54%	72	36.36%
710000-720000	Transport and Communication	154	5.53%	472	6.03%	219	4.42%	19	9.60%
810000-871000	Financing Insurance, Real Estate, Investment and Business Services	505	18.13%	1758	22.46%	962	19.40%	34	17.17%
911100-959200	Community, Social and Personal	181	6.50%	466	5.95%	290	5.85%	14	7.07%
Total		2785	100.00%	7828	100.00%	4960	100.00%	198	100.00%

Table 4 Descriptive Statistics of Inputs and Outputs (all units in ringgit Malaysia)

Statistics	Input			Output	
	Fixed Asset	Current Asset	Paid Up Capital	Revenue	Profit
Kedah (354 companies)					
Mean	21,809,499	22,918,538	9,801,769	26,298,390	1,614,387
Median	561,036	1,059,419	500,000	983,761	60,562
Std Dev	104,266,448	58,499,731	48,953,684	81,078,808	42,722,577
Min	0	2,019	0	0	-644,644,000
Max	1,449,177,000	586,193,533	797,958,000	711,133,563	447,048,138
Penang (315 companies)					
Mean	38,936,976	69,756,720	14,249,309	44,652,461	13,522,816
Median	781,121	4,904,386	500,000	0	264,802
Std Dev	140,245,293	180,883,703	45,437,750	319,918,793	55,498,237
Min	0	15,022	2	0	-3,669,784
Max	1,887,729,052	1,600,810,395	500,000,000	4,192,880,438	630,338,911
Perak (378 companies)					
Mean	38,762,365	25,656,336	11,876,921	42,151,043	4,489,106
Median	457,124	1,570,070	417,746	2,372,016	73,688
Std Dev	241,348,800	66,079,846	39,084,024	146,739,587	28,324,540
Min	0	15,143	2	0	-113,376,723
Max	4,037,512,816	524,169,917	354,010,190	1,850,724,420	443,609,897
Full Sample (1047 companies)					
Mean	33,082,984	37,998,686	11,889,049	37,543,696	6,235,016
Median	576,924	2,620,551	500,000	549,489	93,574
Std Dev	175,021,343	113,957,809	44,522,322	201,913,144	43,058,712
Min	0	2,019	0	0	-644,644,000
Max	4,037,512,816	1,600,810,395	797,958,000	4,192,880,438	630,338,911

Table 5 Pairwise Correlation Coefficient of Inputs and Outputs

Panel 1: Kedah	Fixed Asset	Current Asset	Paid Up Capital	Revenue
Fixed Asset	1	-	-	-
Current Asset	0.5386	1	-	-
Paid Up Capital	0.3887	0.5123	1	-
Revenue	-	-	-	1
Profit	-	-	-	0.5575
Panel 2: Penang	Fixed Asset	Current Asset	Paid Up Capital	Revenue
Fixed Asset	1	-	-	-
Current Asset	0.5272	1	-	-
Paid Up Capital	0.8049	0.3831	1	-
Revenue	-	-	-	1
Profit	-	-	-	-0.0077
Panel 3: Perak	Fixed Asset	Current Asset	Paid Up Capital	Revenue
Fixed Asset	1	-	-	-
Current Asset	0.5521	1	-	-
Paid Up Capital	0.4365	0.6897	1	-
Revenue	-	-	-	1
Profit	-	-	-	0.7999
Panel 4: Full Sample	Fixed Asset	Current Asset	Paid Up Capital	Revenue
Fixed Asset	1	-	-	-
Current Asset	0.4236	1	-	-
Paid Up Capital	0.4653	0.4552	1	-
Revenue	-	-	-	1
Profit	-	-	-	0.4821

5.2 DEA Efficiency Scores

The result of the DEA efficiency scores for individual state analysis and the full sample analysis are reported in Tables 6. We tabulate the efficiency scores into six different efficiency levels and match them by the state origin of the SMEs, so we can observe the proportion of efficiency levels achieved in the three individual-state analyses as well as the full sample analysis. Looking at the tabulation of the proportion, obviously the efficiency scores are distributed with positively skewed, i.e as the score level goes high; the number of SMEs in the category is getting smaller. This is universal across all the four analyses.

In the three individual-state analyses, the numbers of 100% efficient SMEs are 18, 12 and 9 SMEs for Kedah, Penang and Perak, respectively. However, in the full sample analysis, only 20 SMEs manage to achieve 100% efficiency; and out of the 20, Kedah, Penang and Perak have 10, 3, and 7 SMEs, respectively. The proportion of efficient SMEs dropped from 2-5% in the three individual-state analyses to less than 2% in the full sample analysis. Although Penang has more numbers of efficient SMEs than Perak in individual state analysis, but when we pool all SMEs in full sample, Kedah and Perak seem to dominate the list of efficient SMEs. Note that at this stage the order of the efficient units does not imply ranking. The 20 efficient SMEs with 100% scoring are equally efficient according to the basic DEA model. In the DEA scoring process, the ranking for each SME is

based on their benchmark to these 20 efficient SMEs. Further analyses on the DEA benchmark process are provided in section 5.3 and section 5.4, respectively.

Table 6 Frequency of Efficiency Score by Values

State	Efficiency	Number of Companies				
		Kedah	Penang	Perak	Full Sample	Proportion
Kedah	100%	18	-	-	-	5.08%
	≥ 80% but < 100%	3	-	-	-	0.85%
	≥ 60% but < 80%	15	-	-	-	4.24%
	≥ 40% but < 60%	19	-	-	-	5.37%
	≥ 20% but < 40%	37	-	-	-	10.45%
	≥ 0% but < 20%	262	-	-	-	74.01%
Total		354				100.00%
Penang	100%	-	12	-	-	3.81%
	≥ 80% but < 100%	-	6	-	-	1.90%
	≥ 60% but < 80%	-	6	-	-	1.90%
	≥ 40% but < 60%	-	21	-	-	6.67%
	≥ 20% but < 40%	-	53	-	-	16.83%
	≥ 0% but < 20%	-	217	-	-	68.89%
Total			315			100.00%
Perak	100%	-	-	9	-	2.38%
	≥ 80% but < 100%	-	-	3	-	0.79%
	≥ 60% but < 80%	-	-	8	-	2.12%
	≥ 40% but < 60%	-	-	17	-	4.50%
	≥ 20% but < 40%	-	-	50	-	13.23%
	≥ 0% but < 20%	-	-	291	-	76.98%
Total				378		100.00%
Full	100%	10	3	7	20	1.91%
sample	≥ 80% but < 100%	2	2	2	6	0.57%
	≥ 60% but < 80%	4	3	7	14	1.34%
	≥ 40% but < 60%	15	8	7	30	2.87%
	≥ 20% but < 40%	35	35	37	107	10.22%
	≥ 0% but < 20%	288	264	318	870	83.09%
Total		354	315	378	1047	100.00%

5.3 Analyses on the Efficient SMEs - Peers Identification and Input/Output Contribution

In this section, we focus on the perfect-score efficient SMEs. We tabulate these SMEs by their type of business and report the result in Table 7. Basically, the efficient SMEs are mostly from *Wholesale and Retail Trade and Restaurant and Hotels* and *Financing Insurance, Real Estate, Investment and Business Services*. In the individual state analysis, each type of business has at least one efficient SME, with the exception for *Electricity, Gas and Water*. However, for the full sample analysis, there is no efficient SMEs also from *Mining and Quarrying* and *Transport and Communication*. This is somewhat consistent with the sector representative in the tabulation of 15,771 companies in Table 3.

Table 7 Frequency of Efficient SMEs by Type of Business

	Kedah	%	Penang	%	Perak	%	Full Sample	%
Agriculture, Hunting, Forestry and Fishing	0	0.0	0	0.0	1	11.1	1	5.0
Mining and Quarrying	0	0.0	1	8.3	0	0.0	0	0.0
Manufacturing	1	5.6	1	8.3	0	0.0	1	5.0
Electricity, Gas and Water	0	0.0	0	0.0	0	0.0	0	0.0
Construction	1	5.6	1	8.3	2	22.2	4	20.0
Wholesale and Retail Trade and Restaurant and Hotels	8	44.4	3	25.0	2	22.2	6	30.0
Transport and Communication	1	5.6	0	0.0	0	0.0	0	0.0
Financing Insurance, Real Estate, Investment and Business Services	4	22.2	4	33.3	1	11.1	5	25.0
Community, Social and Personal Services	2	11.1	2	16.7	1	11.1	1	5.0
Dormant	1	5.6	0	0.0	2	22.2	2	10.0
Total	18	100.0	12	100.00	9	100.0	20	100.0

To gain an insight on which of the 20 SMEs in the full sample is the best referred efficient SMEs, we proceed to analyze the group of reference peers. The group of reference peers is the selected 1-4 efficient SMEs that each individual company's inputs or outputs benchmark to in calculating the individual DEA score. As the results are too many to be reported, the detail of the group of reference peers for each SMEs are not reported here to conserve space but are available upon request. In Table 8, we tabulate the frequency for each of the 20 efficient SMEs that have been selected in the group of reference peers for the full sample of 1047 companies. Note that with 1047 SMEs, we only can expect a total of 1047 Peer 1, while the rest can be any number less than the total (not all company has more than 1 reference peers).

The most referred efficient SME is arranged in order - from Peer 1, Peer 2, Peer 3 to Peer 4. Among all the 20 efficient SMEs, A327, from the city of Ipoh, appears to be the most referred Peer 1, with 590 times. This is followed by A332 and A397, with 172 and 142 times, respectively. However A332, also from the city of Ipoh, leads the numbers in Peer 2, followed by A397 and A400. K387 is the top referred Peer 3, follows by K393, while K399 is the most referred Peer 4. All the other non-mentioned efficient SMEs have been referred too but the frequency is less than 100 times under each peer category. In total, A332 tops the list, follows by A327 and K387 with 649, 590 and 508 times, respectively. The next most referred group consists of A397 (340 times),

K393 (228 times), K399 (228 times), A400 (200 times) and K324 (197 times). The remaining 12 efficient SMEs are referred less than 30 times in total, and the minimum is 1 time. Of course, we cannot referred to the total frequency to judge on the ranking of the efficient SMEs, as it does not taking into account the weight of different order of the peer group. It is not easy to determine an appropriate weight. Given the close frequency of the top three SMEs, we think the one that dominate Peer 1 should be the most efficient SME, i.e. A327. In short, an obvious pattern in this analysis is that the efficient SMEs from Perak appear to be the leading efficient SMEs and none of the three efficient SMEs from Penang are heavily referred.

Table 8 Frequency of Efficient SMEs as Reference Peers (full sample only)

No	Company Code	Peer 1	Peer 2	Peer 3	Peer 4	Total
1	A129	6	0	0	0	6
2	A220	1	0	0	0	1
3	A327	590	0	0	0	590
4	A332	172	477	0	0	649
5	A386	1	1	0	0	2
6	A397	142	121	77	0	340
7	A400	33	103	64	0	200
8	P113	1	2	0	0	3
9	P280	5	24	0	0	29
10	P343	1	4	0	0	5
11	K077	6	3	1	0	10
12	K137	1	1	0	0	2
13	K228	1	0	0	1	2
14	K277	1	4	4	0	9
15	K314	1	5	3	0	9
16	K324	65	67	65	0	197
17	K336	1	1	0	0	2
18	K387	1	36	424	47	508
19	K393	5	92	113	18	228
20	K399	12	26	54	136	228
	Total	1046*	967	805	202	3020

Note: * radial for A229 is 0%, so there is no reference unit for one company.

To follow up from the group of reference peers analysis, now we report in Table 9 the detail of the input/output contribution that the DEA algorithm has used in achieving the efficient scores. The input/output contribution for each SME is basically collected from their benchmarking process with the group of reference peers. This analysis is a useful indication of which financial input and output have been used in determining the relative efficiency scores, in what percentage, and which have been ignored. The reported values are normalized to show a percentage of the overall input and output contributions. Again, we have to skip the numerical values produced from DEA and report only the frequency for the full sample. The details are available upon request.

Table 9 Frequency of Input-Output Contribution in Determining the Efficiency Score

	Input			Output	
Contribution	Fixed Asset	Current Asset	Paid Up Capital	Revenue	Profit
100	1	71	0	1	4
≥ 80% but < 100%	0	225	17	8	6
≥ 60% but < 80%	2	318	96	7	7
≥ 40% but < 60%	7	265	185	18	15
≥ 20% but < 40%	88	142	301	43	62
≥ 0% but < 20%	949	26	448	970	939
<0	0	0	0	0	14*
Total	1047	1047	1047	1047	1047

Note: there are 14 cases where the contribution is recorded as negative value for profit. What this might implies is that some SMEs might need to reduce its profit have relatively.

At first glance, the result in Table 9 indicates that contribution of the inputs and outputs are not balance. Apparently, current asset is the most frequently referred financial input, as there are more than 71 times it is mentioned as 100% under individual reference peers, and for the rest of the values below 100%, the frequency are also very high; 225 times for 80% and above, 318 times for 60% and above, and 265 times for 40% and above. The remaining low value contributions are 142 times for 20% and above, and 26 times for 0% and above. We do not observe such high contribution for other variables. For example for fixed asset, only one time it has 100% contribution in the reference peer's benchmarking. The rest are concentrated at the very low percentage contribution; 88 times fixed asset is reported to have less than 20%-40% contribution, and 949 times it has less than 20% contribution. Similar pattern happen to the two outputs. In general, we can conclude that current asset is the key factor differentiating the relative performance of the SMEs in NCER.

5.4 Analyses on the Inefficient SME – Target Improvement

In DEA benchmarking analysis, the target improvement for each inputs and outputs are reported for each company. These are basically the slack values calculated in DEA linear programming. To conserve space, we only tabulate the frequency of various target improvement levels in Table 9. The details of the target improvement values for each SMEs are available upon request. This analysis is particularly important for the inefficient SMEs (those scored less than 100%) to identify the area of weakness for improvement. Also, we calculate the average percentage of target improvement across the 1407 SMEs and report them in Panel B of Table 9.

What we can comment on Table 9 is that more than 80% of the companies need to focus on all the three inputs. There are 803, 868 and 883 companies need more than 80% improvement in fixed asset, current asset and paid up capital, and there are 42, 3, and 9 companies need 100% target improvement on these mentioned three inputs, respectively. For the two outputs, around 90% of the SMEs do not require any target improvement, i.e. 0%. Also, 8.2% of the SMEs show a negative target improvement, a technical result that is difficult to interpret. Generally, the target improvement analysis implies that SMEs in NCER are content with oversupply of financial resources (input) relative to their financial performance (output).

Table 10 Frequency of Various Target Improvement Levels and Average Improvement Values for the Inefficient SMEs

Panel A: Frequency of Various Target Improvement Levels										
	Input						Output			
Target Improvement	Fixed Asset	%	Current Asset	%	Paid Up Capital	%	Revenue	%	Profit	%
100%	42	4.0	3	0.3	9	0.9	0	0.0	0	0.0
≥ 80% but < 100%	803	76.7	868	82.9	883	84.3	55	5.3	25	2.4
≥ 60% but < 80%	70	6.7	106	10.1	94	9.0	9	0.9	2	0.2
≥ 40% but < 60%	21	2.0	30	2.9	25	2.4	13	1.2	5	0.5
≥ 20% but < 40%	7	0.7	14	1.3	11	1.1	14	1.3	3	0.3
> 0% but < 20%	3	0.3	6	0.6	5	0.5	14	1.3	9	0.9
= 0%	101	9.6	20	1.9	20	1.9	941	89.9	917	87.6
< 0%	0	0.0	0	0.0	0	0.0	1	0.1	86	8.2
	1047	100.0	1047	100.0	1047	100.0	1047	100.0	1047	100.0

Panel B: Average Improvement Values					
	Input			Output	
Target Improvement	Fixed Asset	Current Asset	Paid Up Capital	Revenue	Profit
Average	82.34%	87.15%	88.13%	125.90%	-367.32%

6. Concluding Remark

This paper investigates relative operating efficiency in utilization of financial resource for SMEs in Malaysia using Data Envelopment Analysis (DEA). Our focus is on SMEs located in the Northern Corridor Economic Region (NCER) which covers four states, comprises Kedah, Penang, Perak, and Perlis and have a population of 16,988 companies in the financial year 2007. We compile and screen the population to exclude those with incomplete information on state code, post code and business code, and left with 15,771 companies. As Perlis only has 198 companies, we exclude it from our analysis. Then, for the remaining three states we exclude investment firm and sample 100 SMEs from four different levels of company size, proxies by total asset. We obtain 1200 companies in total but due to constraint in DEA programming we exclude 153 SMEs with zero revenue and negative profit, and finally left with 1047 SMEs for DEA analysis. The inputs applied are fixed asset, current asset and paid up capital; while the two outputs used are revenue and profit before tax. These input/output basically are free from multicolinearity problem and hence we are at the safe side in applying DEA.

Basically the efficiency scores of SMEs in NCER are positive skew tabulated. For the full sample analysis, less than 2% of the sample (20 SMEs) manages to achieve 100% efficient and they are mostly from the sector of *Wholesale and Retail Trade and Restaurant and Hotels*, follows by *Financing Insurance, Real Estate, Investment and Business Services*, and *Manufacturing*. This is consistent with the sector representative in the pool of total screened population, which involve 15,771 companies. Although Penang has more numbers of efficient SMEs than Perak in individual state analysis, but when we pool all SMEs in full sample, Kedah and Perak seem to dominate the list of efficient SMEs. From the peer identification analysis, we find that the efficient SMEs in Perak are relatively better compared to the rest. In the analysis on input/output contribution, we identify that the key variable in the DEA benchmarking process is current asset. Also, for the inefficient SMEs, the target improvement analysis suggests that they should focus on how to minimise all the three financial inputs.

This study delivers three important findings. First, the efficiency of channelling financial resources is not according to company size; this is true at least in the NCER region. This finding is reflected in various different analyses on the efficient and inefficient SMEs. Second, the SMEs in NCER need to focus on efficient utilization of financial resources, instead of revenue or profit generating. Generally, they can gain efficiency by reducing wastage in financial resources. Finally, the distribution of financial efficiency is not balance across the three states in NCER. For the first and third points, our findings are very much consistent with Korean case as reported in Yang (2006).

Surprisingly, Penang as the second leading economic state after the capital state Kuala Lumpur, is not showing any dominancy in SMEs' financial efficiency rating in NCER. Anyhow, this study only focuses on one financial year 2007. To enable a strong and robust policy recommendation, we should proceed to compare time series behaviour of the financial efficient scores. Also future study can extend the comparison with SMEs in other regions and states in the country, especially those in Kuala Lumpur and Johor. Another extension include cross industry comparison and benchmarking to SMEs in other emerging market as in Tan and Batra (2003).

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