Relative Efficiency of Students in Terms of Employability: A Linear Programming Model

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This paper measures the relative efficiency of the students in terms of job employability in Malaysia by using the non-parametric model of data envelopment analysis. The subjects of the sample are fresh graduates with the specialization in Hotel and Tourism Management (HTM) from University Teknologi MARA (UiTM), who have just entered into the job markets. The inputs taken for this study include entry and exit level CGPA and performance of the students in each semester of the degree course, whereas the outputs are job level and salary level of the students. Each student is considered as the decision making unit. The efficiency of each unit is calculated relative to all other observations and itself. The results reveal that the efficiency in terms of employability for some of the students is below the potential level in spite of a relatively good entry and exit qualification and better overall academic performance. It could be related to their family background, economic and social factors, overall outlook, smartness and communication skills. There is an ample opportunity to improve the employability of most of the graduates specializing in Hospitality and Food Service Management.

Key words: DEA, relative efficiency, employability, entry and exit qualifications, academic performance.

Introduction

The rapid growth of international tourism in Asia and the Pacific over the years has generated not only income for the countries involved, but also enormous employment opportunities (Goldsmith and Zahari, 1994). Employment in the tourism industry in Malaysia is quite high. It was reported in 1999 that the total direct tourism employment rose 22 percent from 113,819 to 138,943 (Tourism Malaysia, 1999). In 2000, the majority of hospitality employees were Malaysians (Tourism Malaysia, 2002). This is in contrast to the situation in the last two decades when employers had an over-reliance on expatriate management in key jobs. It was common practice to recruit managers, senior executives and executive chefs from abroad (Goldsmith and Zahari, 1994), while locals filled only lower level positions.

Given the importance of the hospitality industry as an employer in Malaysia, this research into employability in the industry has a practical relevance. The government commitment through the introduction of the hospitality apprenticeship programme under the Human Resource Development Council (HRDC) in 1996 (HRDC, 1998) and the introduction...

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of undergraduate courses at public and private institutions reduced the so called lack of co-
ordination (Goldsmith and Zahari, 1994) between the industry, training institutions and
government. This had led to the establishment of a trade skill standard that universally
recognized hospitality criteria of excellence (HRDC, 1999). Better preparation in education
for working life is an important way of facilitating the transitions to stable and satisfying
employment. Employers and employees benefit from good job preparation in terms of

The notion that it is desirable for graduates of universities and colleges to be
employable at the end of their education has become a basic tenet in many areas such as in
education, training, psychology and human resource management (Rynes and Gerhart, 1990).
For example, questions concerning employability have provided much impetus for research
in the graduate labour market (Fenton, 2000), higher education and the world of work
(Teichler, 1999a, 1999b), education and training (Mutch, 1998), skills and competences
(Hughes, 1999), occupational psychology (Rynes and Gerhart, 1990; Kluytmans and Ott,
1999), job performance (Taylor, 1986), job security (Basile, 1997; Garavan, 1999), learning
partnerships (Clarke, 1997; Hughes, 1999) and lifelong learning (Teichler, 1999a; OECD,
2000).

Researchers now are nearing a greater commonality of understanding of
‘employability’ and are extending that through contingency approaches on its
conceptualisation (Hughes and Stoner, 2000). The debates will help answer some questions
about graduate outcomes. For example, if students do well in their programme of study, how
is this related to their entry and exit qualifications? How are graduate outcomes related to
their academic performance and progression? Does it have any relation to their personal
attributes and demographic background? To what extent do their entry qualifications relate
to their exit qualifications and subsequent job? How true are the remarks that employers still
value students’ skills and personal traits more than academic grades and academic
reputations? How true is the belief that having employability skills and competences increase
the probability of career success?

Hospitality Graduates

Why study hospitality graduates? There is a considerable amount of literature discussing the
issue of graduate employment and work transitions in general, (Teichler, 1999a; Woodley
and Brennan, 2000; Fenton, 2000, Hughes, 1999), accounting (Maz Ainy, 1999), business
marketing (Borde, 1998), engineering (Backs and Sanders, 1998) and nursing (Andrew,
1998). Unlike other disciplines, which are more established and better developed with a long
history of knowledge accumulation (Soh, 1996), hospitality has a fundamental problem due
to its relative immaturity in academia as a field of study (Soh, 1996). Its shallow base of
knowledge often renders it inferior added with the complex nature of the industry (Wade,
1999).

The integration of the diverse groups in tourism industries (where hospitality is said to
be) has been hindered because the industries do not have a common product and are linked
only by the shared customer, the tourist. So much so, there is little agreement between
government, industry and academics as to what actually constitutes the hospitality disciplines
(Cooper et al., 1994), therefore, the needs of training and education activities are difficult to
be identified comprehensively (Soh, 1996) thus, potentially hindering the educational
provision.

Furthermore, there is an inevitable lack of understanding on the part of employers of
the benefits of education. Soh (1996) pointed some barriers such as;
a) Lack of recognition for qualifications in the positioning of graduates upon employment (also pointed out by NEDC, 1991).

b) Lack of career prospects due to weak labour market.

c) Lack of want to employ graduates with little practical skills.

Employers filling entry-level positions value applicants’ skills and personal traits more than university grades, college reputations, or membership in professional associations (Geissler and Martin, 1998), as compared to engineering (Backs and Sanders, 1998) and accounting (Maz Ainy, 1999). Employers in the hospitality industry could not compete with other industries as well as competitors in the same industry who were offering higher salaries and more favourable working condition (Goldsmith and Zahari, 1994).

When hospitality operations acquire new managers from hospitality management institutions, these formally educated graduates come fundamentally equipped with inert knowledge (i.e. definitions, principles, and concepts) about the hospitality industry (Feinstein and Mann, 1998). Common curriculum requirements in hospitality provide students with good understanding of the formal techniques associated with the specifications of a product, costing of a menu, rules of safety and sanitation, concept of business marketing and the like (Feinstein and Mann, 1998; Knutson and Patton, 1992). However, although most graduates have extensive personal experience, they typically do not have a great deal of understanding in real-life application. Furthermore, Okeiyi, Finley and Postell (1994) state that hospitality students are “inadequately prepared in some of the skills needed to succeed in the hospitality industry.”

Stemming from this, the learning needs of students, industry expectations, and rapidly changing technology require hospitality management education (HME) institutions to use active learning strategies in conjunction with technology to educate the workforce. Since today’s students are more technologically advanced, demand an active/cooperative learning environment, and tend to be more visual learners, HME institutions need to focus frequently on active learning strategies and not on ‘hypothetical and unrealistic examples’ (Umbreit and Diaz, 1994).

Finally, where do hospitality graduates go? Johns and McKechnie (1995) reported that only 50 percent of graduates choose careers within the industry. What happened to the other 50 percent? Thus, a study on their academic performance, attributes, education and employment outcomes is inevitable.

Naim (2003) studied the performance indicator (PI) of hospitality graduate’s (Figure 1) starting from input – early education and entry qualification; process – performance while in the institution; output – exit qualification; and outcome – employability. He reported that with regards to hospitality graduates, there was no correlation between input, process and outcome. Significant correlation only found between process and output. He further deduced that since hospitality is a highly serviced and skill oriented industry, academic achievement was not a determinant of success and being employable.

![Figure 1: Graduate employability model (GEM)](image-url)
This study uses the technique of data envelopment analysis, a linear programming model to evaluate the relative efficiency in terms of employability of 59 fresh graduates with the specialization in Hospitality and Food Service Management who have already entered into the job markets. The efficiency of each student hereafter known as unit is evaluated relative to all other units and itself. The academic performance measured in terms of Age, entry level CGPA, exit level CGPA and the class obtained, have been taken as the inputs to achieve a satisfactory level of output, measured in terms of job level and salary level in the job market. Further, it also evaluates the potential improvements of different inputs and outputs for the inefficient units.

**Methodology**

Currently, two methods are used to measure technical efficiency (TE): econometric estimation of production frontiers and data envelopment analysis (DEA). The econometric approach to estimating TE assumes an explicit functional form for the underlying production technology. In contrast, DEA, originally pioneered by Charnes et al. (1978), does not require any underlying assumptions. It enables one to obtain extremal relations such as the production function and/or production possibility surfaces. Instead of trying to fit a regression plane, it floats piecewise-linear/Cobb-Douglas (log-linear) surface to rest on the top of the observations (Seiford, 1990).

**Measurement of Technical Efficiency: DEA**

The extent by which a decision making unit (DMU) lies below its production frontier, which sets the limit to the range of maximum obtainable output, can be regarded as the measure of technical efficiency. The concept of technology and output-oriented technical efficiency can be explained in Figure 2, involving single input (x) and single output (y).

Consider a set of 4 decision making units (DMU) - A, B, C, and D. Given the free disposability of inputs and outputs and convexity condition, the free disposal convex hull of the observed input-output vectors provides us an inner approximation to the true underlying production possibility set. If additionally, one assumes constant returns to scale (CRS), all non-negative input-output bundles will also be feasible. The production possibility set becomes a convex cone. By convexity, all points in the convex hull of the points A, B, C and D (i.e., all convex combinations of these points) represent feasible input-output combinations.

![Figure 2: Technical Efficiency](image)

The free disposal convex hull is set of points bounded by the horizontal axis and the broken line MABD – extension. Under variable returns to scale (VRS), all points in this region represent feasible input-output combinations. Under CRS, however all radical extension and (non-negative) contractions of feasible input-output bundles are also feasible. Thus the CRS production possibility set is the cone formed by the horizontal axis and the ray.
OR through the point B. As it can be seen from the Figure1, DMU/Country C is technically inefficient as it is lying below the frontier of the technology. The output–oriented technical efficiency is measured by the amount by which output could be increased without requiring extra inputs. In other words, it is the ratio of actual output to potential output. Hence, the technical efficiency of the DMU C is the ratio \( NC/NC' \) under CRS and the ratio \( NC/NC'' \) under VRS.

Assuming \( k=1, \ldots, K \) DMUs using \( n =1,\ldots, N \) inputs to produce \( m = 1, \ldots, M \) outputs at each time period \( t =1, \ldots, T \).

The reference frontier (or technology) in period \( t \) is constructed from the data as:

\[
S' = (x^t, y^t): y_m^t \leq \varepsilon \sum_{k=1}^{K} Z^{k,t} y_m^{k,t}; \sum_{k=1}^{K} z_n^{k,t} x_n^t \leq x_n^t; Z^{k,t} \geq 0
\]  

(1)

This exhibits constant returns to scale and strong disposability of inputs and outputs (Fare et al. 1994). Following Afriat (1972), the assumption of CRS can be relaxed and one may allow for variable returns to scale by putting the following restriction in (1) (Banker et al., 1984):

\[
\sum_{k=1}^{K} Z^{k,t} = 1
\]  

(2)

where, \( Z^{k,t} \) is an intensity variable indicating at what intensity a particular activity (farm) may be employed in production.

The distance function seeks the reciprocal of the greatest proportional increase in output(s) given input(s), such that output is still feasible. The output distance function at \( t \) is defined as:

\[
D_o^t = \text{Min} \theta : (x^t, \frac{1}{\theta} y^t) \in S'
\]  

(3)

It completely characterizes the technology \( D_o^t \leq 1 \), if and only if \( (x^t, y^t) \in S' \). In addition, \( D_o^t = 1 \), if and only if \( (x^t, y^t) \) is on the boundary or frontier of the technology.

The output distance function under CRS technology is calculated by following linear programming problem:

\[
\{ D_o^t (x^t, y^t) \}^{-1} = \text{max} \theta^k
\]  

s.t. \[
\sum_{k=1}^{K} Z^{k,t} x_n^{k,t} \leq x_n^{k,t}; \quad n =1, 2, \ldots, N
\]
\[
\sum_{k=1}^{K} Z^{k,t} y_m^{k,t} \geq y_m^{k,t} \theta; \quad m =1, 2, \ldots, M
\]
\[
Z^{k,t} \geq 0, \quad k =1, 2, \ldots, K
\]  

(4)

The output distance function under VRS technology can be calculated by putting the restriction (2) in the above LP problem.

**The Data**

The study was conducted on a convenience sampling of 186 students who joined the Faculty of Hotel and Tourism Management (FHTM), University Teknologi MARA in Malaysia graduating from year 1999 to year 2001. The cohorts were those graduated with Bachelor in Hotel Management, Bachelor in Food Service Management, Diploma in Hotel Management and Diploma in Food Service Management from Faculty of Hotel and Tourism Management of UiTM. The first cohort of the Diploma enrolled in 1996 and graduated in 1999 and the last cohort enrolled in 1998 and graduated in 2001. For the degree courses, the first cohort
enrolled in 1997 and graduated in 1999, and the last cohort enrolled in 1999 and graduated in 2001. Out of total sample of 186, only 59 fresh graduates’ data were taken into consideration for this study as the information on job and salary levels were not available for the rest of the sample.

Inputs included Age, entry level CGPA, Average marks in Semester 1, Average marks in Semester 2, Average marks in Semester 3, Average marks in Semester 4, exit level CGPA and class obtained in degree. The number of outputs considered was two – job level and salary level. Each student was considered as the decision making unit and as such 59 units were evaluated. The efficiency of each unit is calculated relative to all other observations and itself.

Results and Discussion

The Model

In this study, each student is treated as a separate DMU. The number of DMUs $k = 59$. The number of inputs $n = 8$, the number of outputs $m = 2$. The decision variables are the shadow prices $1, 2, \ldots, 59$. The expansion factor is $\theta$ in the output oriented model. The study is required to maximize the objective functions $D_0$ subject to respective constraints. The LP problem (given in 4) is run 59 times to obtain the efficiency estimates of all the DMUs (students).

Relative Efficiency of Units

Table 1 shows the percent relative technical efficiency of units in terms of employability. As it can be observed, out of 59 units, 16 units are technical efficient with full efficiency of 100 per cent. The rest 43 units are relatively efficient with the efficiency score less than 100 per cent. It indicates 43 inefficient units are job levels or/and salary below their potential levels. The average efficiency of all 59 units is around 88%.

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The efficiencies achieved by different units are shown through the scattered points in Figure 3a followed by the distribution of efficiency scores shown in Figure 3b. The observations on the top horizontal straight line are technically efficient whereas the observations below the line indicate that they are inefficient. The level of efficiency can be observed in terms of distance between the scatter points and the X-axis. The larger the distance of an observation from X-axis, the higher is the relative efficiency and vice-versa.

**Figure 3a Relative Efficiency of Units: DEA**

![Figure 3a Relative Efficiency of Units: DEA](image)

**Figure 3b Frequency Distribution of Efficiency Scores**

![Figure 3b Frequency Distribution of Efficiency Scores](image)
As it can be seen from Figure 3b, 16 units are technically efficient with score of 100 per cent. Another 14 units, though inefficient but achieve very high efficiency score within the range of 91 to 99.9 percent. There are 2 units whose efficiency score is below 50 per cent.

**Reference Set**

The reference set is the set of efficient units to which an inefficient unit has been directly compared to calculate its efficient score. Figure 4 shows the reference frequency of all 16 efficient units. Unit 6 has been compared 29 times, at maximum, to calculate the efficiency of inefficient units, followed by unit 53 with the number of comparison of 24 times. The units 56, 38, 21 and 2 have the lowest reference frequencies of 2 each.

**Potential Improvement of Inputs and Outputs**

Figures 5 to 7 show the potential improvements of inputs Age, CGPA entry level, and CGPA exit level respectively. The graphs display the number of units that show potential improvements in a certain range. A large number is indicative that some efforts should be made to improve the respective factor.

As it can be observed from Figure 5, most of the units are in 0 to 20 per cent improvement range of AGE. It indicates that the current level of job or/and salary level could have been achieved for 38 units (28 + 10) at the lower age by (0 to 20) percent of the current age. Similarly, most of the units are in the range of 0 – 30 per cent improvement of entry
level CGPA, which imply that 48 units (25 + 12 + 11) could have achieved the current level of job or/and salary with the lower entry level CGPA by 0 – 30 percent of current level of entry CGPA. Finally, so far as the exit level CGPA is concerned, most of the units are also in the same range of improvement that is 0 – 30 per cent.

**Figure 6** Potential Improvement of Input: CGPA Entry Level

![Figure 6](image)

**Figure 7** Potential Improvement of Input: CGPA Exit Level

![Figure 7](image)

Figures 8 and 9 show the potential improvement of outputs – job level and salary level. As it can be seen from Figure 6, most of units are in the range of potential improvement in job level by 0 – 10 percent. It indicates that, given the inputs – age, entry level CGPA and exit level CGPA, most of the units (56) could have achieved job level higher by 0 – 10 per cent of the current job level. Similarly, as shown in Figure 9, the salary level could have been achieved more by 0 – 10 per cent for most of the units.

**Figure 8** Potential Level of Output: Job Level

![Figure 8](image)
Conclusion

In spite of good academic performance, some of the students are lagging behind their peers. Out of 59 students, only 16 students are technically efficient in terms of employability. The rest of the students are relatively inefficient possibly because of other factors such as family background, social and culture, smartness and communication skill. The study reveals that there is an ample opportunity to improve the employability of most of the graduates in Hospitality and Food Service Management. Out of 59 students, 53 students have the potential to achieve better job levels by 0 to 10 percent and 56 students have the potential to achieve better salary levels by 0 to 10 percent.

This study considers employability as the function of academic performance alone. Because of non-availability of data on factors other than academic performance, it could be argued that some of the important factors, such as family background, economic and social factors etc, may had significant impact on employability of the students.

References


Education, 10(3), 19-27.


