UNIVERSITI PUTRA MALAYSIA

DATA ENVELOPMENT ANALYSIS FOR TARGET SETTING WITH IMPRECISE DATA

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ABSTRACT

In this thesis, a new aspect of target setting in data envelopment analysis is presented. The existing data envelopment analysis (DEA) target models are defined just for exact data. Considering the importance of imprecise data such as fuzzy, ordinal and interval data in organizations, DEA target models and method are proposed with some advantages over the previous ones, and also defined for imprecise data. The suggested target models for imprecise data are originally non-linear mathematical programming problems, but two proposed methods are used to convert them to the linear ones.

The different aspects of target setting in DEA are discussed. By these new approaches, the drawbacks of the existing methods and models defined for target setting process in DEA are rectified. The problems in which the centralized decision makers encountered limited or constant resources for total input consumption or total output production are solved in this thesis. A new DEA target model which solves and deals with such a situation is also established.

The relation between the multiple objective linear programming and data envelopment analysis is discussed. The existing models established during the investigation of the relations between the output-oriented dual DEA model and the mini-max reference point formulations are the super-ideal point model, the ideal point model and the shortest distance model. Through these models, the decision maker's preferences will be considered by interactive trade-off analysis procedures in multiple objective linear programming. These models considered only the output-oriented dual DEA model which is a radial model that concentrates the increase in outputs. These models are also improvements to the cases which consider the decrease of total input consumption and the increase of total output production simultaneously which results in solving only one rather than n mathematical programming problems.

Numerical illustrations are provided at each chapter of this thesis to show the advantages of the established imprecise target models over the existing ones. Considering the wide application of data envelopment analysis in organizations, one of the established models is applied to the evaluation of efficiency and resource allocation of commercial banks in Malaysia.

Finally, the discussions on some approaches in our researches are presented. Future studies and potential improvements are also given to conclude this thesis.

Abstrak tesis untuk dibentangkan kepada Senat Universiti Putra Malaysia bagi memenuhi syarat Ijazah Doktor Falsafah.

PENENTUAN SASARAN ANALISIS PENYAMPULAN DATA DENGAN DATA BUKAN PERSIS

Oleh

NAJMEH MALEKMOHAMMADI

Pengerusi : Profesor Madya Azmi Bin Jaafar, Ph.D.

Fakulti: Institute Penyelidikan Matematik

ABSTRAK

Dalam tesis ini aspek baharu penentuan sasaran dalam analisis penyampulan data (DEA) dipersembahkan. Model tersedia bagi penentuan sasaran DEA hanya tertakrif bagi data tepat sahaja. Dengan mengambil kira kepentingan data bukan persis, seperti data kabur, ordinal dan selang dalam sesebuah organisasi, kaedah dan model baharu DEA diketengahkan dengan beberapa kelebihan daripada model sasaran terdahulu, dan juga ditakrifkan ke atas data abukan persis. Model sasaran data bukan persis yang dicadangkan adalah pada asalnya masalah pengaturcaraan bermatematik tak linear, tetapi dua lagi kaedah yang dicadangkan digunakan untuk menjelmakannya kepada masalah linear.

Beberapa aspek penentuan sasaran dalam DEA dibincangkan. Dengan pendekatan baharu ini, beberapa kelemahan kaedah dan model tersedia yang ditakrifkan bagi proses penentuan sasaran dalam DEA diperbaiki. Masalah yang ditemui pembuat keputusan berpusat tentang sumber terhad atau sumber pemalar bagi jumlah penggunaan input atau jumlah pengeluran output diselesaikan dalam tesis ini. Satu

model sasaran DEA baharu yang menyelesaikan dan mengendalikan situasi tersebut juga dibangunkan.

Hubungan di antara pengaturcaraan linear objektif berganda dan analisis penyampulan data dibincangkan. Model tersedia semasa penyiasatan dilaksanakan terhadap hubungan model dual DEA yang berorientasikan output dan perumusan titik rujuk min-maks ialah model titik super-unggw, model titik unggw dan model jarak terdekat. Melaui model ini, kecenderungan pembuat keputusan dipertimbangkan dengan prosedur analisis penukaran interaktif dalam pengaturcaraan linear objektif berganda. Model-model ini hanya mengambilkira model dual DEA berorientasikan output sahaja, iaitu model radial yang menumpukan kepada penambahan output. Model ini dipertambahbaikan dengan mengambilkira pengurangan penggunaan jumlah input dan penambahan jumlah pengeluaran output secara serentak, yang menghasilkan penyelesaian kepada hanya satu, dan bukan n masalah pengaturcaraan bermatematik.

Contoh berangka diberikan pada tesis ini untuk menunjukan beberapa keputusan yang diperlukan bagi model sasaran bukan persis terbina ke atas model tersedia. Dengan mempertimbangkan DEA penggunaan secara meluas dalam organisasi, satu dari model baharu yang terbina dilaksanakan terhadap penilaian keberkesonan dan penagihan sumber bank komersial di Malaysia.

Akhirnya, perbincangan terhadap beberapa pendekatan dalam penyelidikan ini akan dipersembahkan. Kajian masa hadapan dan penambahbaikan juga disediakan bagi mengakhiri tesis.

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APPROVAL SHEET 1

I certify that Examination Committee has met on date of viva voce to conduct the final examination of Najmeh Malekmohammadi on her Degree of Doctor of Philosophy thesis entitled " Data Envelopment Analysis for Target Setting with Imprecise Data'' in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the student be awarded the Degree of Doctor of Philosophy.

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APPROVAL SHEET 2

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of Supervisory committee were as follows:

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DECLARATION

I hereby declare that the thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and it is not concurrently, submitted for any other degree at University Putra Malaysia or at any institutions.

NAJMEH MALEKMOHAMMADI

Date:

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