PROSIDING

SEMINAR KEBANGSAAN

SAINS, TEKNOLOGI & SAINS SOSIAL

27 ~ 28 MEI 2002
HOTEL VISTANA, KUANTAN, PAHANG

Anjuran :

Universiti Teknologi MARA
Cawangan Pahang

Dengan Kerjasama

Kerajaan
Negeri Pahang Darul Makmur

JILID 1

OPTIMIZING LOG SUPPLY FROM TIMBER CONCESSION COMPLEX, DUNGUN, TERENGANU TO THEIR SUBSIDIARIES DOWN STREAM PROCESSING MILLS USING LINEAR PROGRAMMING MODEL#

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ABSTRACT

This paper attempts to solve the problem of irregular supply of logs to the mills within the same holding company. Linear programming model analysis has been used in solving this problem. The logs supply from concession area is not sufficient. Buying additional logs from other log yards to meet the demand by the mills is recommended. The study shows that the supplier company can increase its net income by RM 1.5 million (before tax) if the log supply to the mills by buying logs buying from other concession areas is improved to an efficient manner.

Key words: Optimization, net income, distribution, logs

INTRODUCTION

Linear programming (LP) is mathematical techniques that are concerned with optimization, that is with finding the best possible answer to a problem. They are often associated with the wider field of operations research. They have been studied and researched since the late (Beasley, 1996). In the actual fact, LP is an aid to decision making in the field such as forestry, agricultural, industry, business and service sectors. It is a procedure that has found practical application in almost all kinds of business, from advertising to production planning. Transportation, distribution and aggregate production planning's are the most typical objectives of LP analysis. It is important for the reader to appreciate/understand at the outset that the *programming in LP* is of a different meaning than *the programming in 'computer programming'*. In the former case it means to plan, while in the latter it means to write instructions for performing calculation.

As mentioned earlier, LP is a method of determining an optimum program of interdependent activities within available resources. The term linear assumes that all relationships involved in the particular problem to be solved by this method are linear. The term programming refers to the process of determining a particular program or plan of action. A linear programming arises whenever two or more activities compete for limited resources. According to Schrage (1986) linear programming is a mathematical procedure for determining optimal allocation of scarce resources. It is not only capable of allocating the resources in order to achieve optimal return but also capable of selecting the most profitable activities in the business operation. In agricultural project, LP model has been used as investment decision model in regional land evaluation for maximizing profit by utilizing the available resources (Ahmad Fauzi, 1994). In fact optimization planning is a refinement of conventional planning, which is emphasizes more on the solving of optimal plan to satisfy feasibility constraints (Loucks, 1985). This concept is applied under this study.

PROBLEM OF THE STUDY

This study attempts to examine the problem of irregular log supply from Timber Concession Complex, Dungun, Terengganu to their processing subsidiary companies i.e. Syarikat PESAMA Timber Corporation Sdn Bhd, PESAKA Terengganu Berhad and PERMINT Plywood Sdn Bhd. These processing mills are subsidiary companies under the Golden Pharos Berhad, a public listed company. In fact the Timber

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Complex's is responsible for supplying of raw logs to these mills. At the moment, Timber Concession Complex's could only managed to supply about 70% of the total logs requirement and each subsidiary company was requested to purchase the balance from outside Timber concession Complex. This study tries to determine how much profit could be achieved if all the logs supply is provided by The Timber Concession complex. Hence the mills could concentrated only on the down stream processing activities.

THE SCOPE OF THE STUDY

This study was carried out at Timber Concession Complex, which is located at Bandar Bukit Besi, District of Dungun, Terengganu, in the east coast of Peninsular Malaysia. The total concession area own by Timber Concession Complex is about 108,900 ha; out of this area only 3,200 ha are allow to be logged per year. This study also used a secondary data obtained/derived from the Timber Concession Complex, Dungun, Terengganu and the processing mills to examine the problem of irregular log supply as well as the distribution of logs to the processing mills.

THE OBJECTIVES OF THE STUDY

In general, the objective of this study was to determine the optimal logs distribution supply from Timber Concession Complex to the processing mills in order to optimize net return for one-year accounting period. The optimizing process would be considered by which Timber Concession Complex could produced logs within the existing limited annual coop allowed for harvesting in order to optimize the most efficient manner it's net return. The detailed working objectives of the study were as follows:

i) To estimate the expected net return of Timber Concession Complex for one-year period with and without purchase logs from outside concession areas in order to supply all the three mills;

ii) To compute the quantity of logs required to be purchased by Timber Concession Complex from other concession areas which for supplying the mills;

iii) To compute the additional cost required if Timber Concession Complex acts as the only supplier of logs to these three mills.

Other than that, this study would like to find out the volume of logs required according to grade need to be purchased from outside to meet the total requirement of all the three subsidiary processing mills.

METHODOLOGY OF THE STUDY

This study used LP to optimize the log distribution from Timber Concession Complex to the mills and optimize the net return subject to the limited supply of logs. The amount of log supply is very much dependent on the predetermined quantity of demand by the processing mills. Generally, the LP model can be written as follows;

Maximize { Net return}

Subject to

{Supply constraints}
{Input requirement/cost requirement per unit by grade}
{Demand constraints from the mills}

This model ultimately would maximize the net return of Timber concession complex operation for one year with limited log supply. The model is also capable of to estimate the amount of logs required from other concession areas open market in order to meet the demand by the subsidiary mills by adding the buying component variables. This analysis will use Linear Integer and Quadratic Programming Program (LINDO) software.

THE ASSUMPTIONS OF THE MODEL

LP is one of the most powerful economics tools in solving the optimization problem for planning over 30 years, but a number of assumptions are made (Hazell & Norton 1986). They are listed as follows:

i) Optimization
The objective function is maximized or minimized. The above model maximizes the net return.

ii) Fixedness
Linear programming matrix is at least a one non-zero constraint for the right hand side coefficient.

iii) Finiteness
It is assumed that there are only a finite number of activities and constraints to be considered so that a solution may be sought.

iv) Determinism
All the coefficients used in the linear programming model matrix are assumed to be known constraints.

v) Continuity
Resources can be used and activities produced in quantities that are fractional units.

vi) Homogeneity
All units of the same resource or activity are identical.

vii) Additivity
The activities are assumed to be additive in the sense that when two or more are used, their total product is the sum of their individual products. That is, no interaction effect between activities are permitted; and

viii) Proportionality
The net farm income and resource requirement per unit of activity is assumed to be a constraint according to the mill requirement.

ix) Service Charges
Timber Concessionaire Complex will charge 8% for service charged on the logs selling price to the processing mills.

The addictively and proportionality together define linearity in the activities, thereby giving rise to the name linear programming.

THE DATA FOR THE STUDY

This study was based on the data provided by Timber Concession Complex. The most important data to be acquired for the LP matrix is the cost per meter cubic. This is the basis of selecting logs to the appropriate mills for maximizing the net return. The buying and selling price of logs according to grade are next in importance variable for the study. LP should be able to select the low buying price and high selling price of log. Other than that, the constraints in the form of the quantity demand required by the mills according to grade also played an important role in determining the type(s) of logs to be purchased. The data used from this study are shown in the tables below.

Table 1: Average conventional logging cost per cubic meter (RM/m^3)

ACTIVITIES	RM/m3	%	Standard Deviation
Premium	23.63	16.73	8.78
Pre-F inventory	0.45	0.32	0.17
Tree marking	0.95	0.67	0.34
Boundary delineation	0.15	0.11	0.08
Harvesting	50.41	35.69	4.48
Royalty & silvicultural cess	22.31	15.79	0
Closing report	0.38	0.27	0.15
Post-F inventory	0.6	0.42	0.21
Forest treatment	1.32	0.93	0.49
Road and matau construction	3.75	2.65	2.14
Administration	37.3	26.41	16.3
Total	141.25	100.00	

Table 2: Average buying and selling price of logs per cubic meter (RM/m^3)

Items#	Buying price	Selling price
Grade 1	712	768.96
Grade 2	502	543.24
Grade 3	323	348.84

Grade 1 – Heavy hardwood, Grade 2 – Medium hardwood, Grade 3 – Mixed hardwood.

Table 3: Average quantity of logs (raw) required by mills per year (m^3/yr)

Items	Pesama Timber Corp Sdn Bhd	Pesaka Terengganu Bhd	Permint Plywood Sdn Bhd	Total (m^3)
Grade 1	17,500	18,000		35,5000
Grade 2	8,750	9,000	30,000	47,750
Grade 3	8,750	9,000	30,000	47,750
Total	35,000	36,000	60,000	131,000

Table 4: The quantity of logs available based on pre-F inventory per year (m^3/yr)*

Items	Quantity (m^3/year)
Grade 1	25,000
Grade 2	40,000
Grade 3	25,000
Total	90,000

* This is the capacity of Timber Concession Complex production per year. It is assumed that the rest of quantity required is bought from outside.

THE ESTIMATED LINEAR PROGRAMMING MODEL

Based on the objectives of the study, which are to maximize the total net return, and at the same time to optimize the log distribution to the mill as requested by the processing mills. Considering the objectives and the data required, the estimated LP model is as shown below.

The Model:

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MAX - 712 BUY_G1 - 503 BUY_G2 - 323 BUY_G3 - 141.25 KP1 - 141.25 KP2
   - 141.25 KP3 + 686 PE1 + 518 PE2 + 308 PE3 + 686 BE1 + 518 BE2
   + 308 BE3 + 518 FY2 + 308 FY3 + 768.96 PE1B + 543.24 PE2B
   + 348.84 PE3B + 768.96 BE1B + 543.24 BE2B + 348.84 BE3B
   + 543.24 FY2B + 348.84 FY3B

SUBJECT TO

   KP1 =   25000
   KP2 =   40000
   KP3 =   25000
   23.63 KP1 + 23.63 KP2 + 23.63 KP3 >=   0
   0.45 KP1 + 0.45 KP2 + 0.45 KP3 >=   0
   0.95 KP1 + 0.95 KP2 + 0.95 KP3 >=   0
   0.15 KP1 + 0.15 KP2 + 0.15 KP3 >=   0
   50.41 KP1 + 50.41 KP2 + 50.41 KP3 >=   0
   22.31 KP1 + 22.31 KP2 + 22.31 KP3 >=   0
   0.38 KP1 + 0.38 KP2 + 0.38 KP3 >=   0
   0.6 KP1 + 0.6 KP2 + 0.6 KP3 >=   0
   1.32 KP1 + 1.32 KP2 + 1.32 KP3 >=   0
   3.75 KP1 + 3.75 KP2 + 3.75 KP3 >=   0
   41.03 KP1 + 37.3 KP2 + 33.57 KP3 >=   0
   KP1 - PE1 - BE1 >=   0
   KP2 - PE2 - BE2 - FY2 >=   0
   KP3 - PE3 - BE3 - FY3 >=   0
   BUY_G1 - PE1B - BE1B >=   0
   BUY_G2 - PE2B - BE2B - FY2B >=   0
   BUY_G3 - PE3B - BE3B - FY3B >=   0
   PE1 + PE1B <=   17500
   PE2 + PE2B <=   8750
   PE3 + PE3B <=   8750
   BE1 + BE1B <=   18000
   BE2 + BE2B <=   9000
   BE3 + BE3B <=   9000
   FY2 + FY2B <=   30000
   FY3 + FY3B <=   30000
   - 712 BUY_G1 + C_GRD_1 >=   0
   - 503 BUY_G2 + C_GRD_2 >=   0
   - 323 BUY_G3 + C_GRD_3 >=   0
   PE1 + PE2 + PE3 + PE1B + PE2B + PE3B =    35000
   BE1 + BE2 + BE3 + BE1B + BE2B + BE3B =    36000
   FY2 + FY3 + FY2B + FY3B =    60000
   PE1 + BE1 =    25000
   PE2 + BE2 + FY2 =    40000
   PE3 + BE3 + FY3 =    25000
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Table 5: Description of Variables.

Variable name	Description
BUY_G1	Buying grade 1 logs from outside KPKKT
BUY_G2	Buying grade 2 logs from outside KPKKT
BUY_G3	Buying grade 3 logs from outside KPKKT
KP1	Log production grade 1 by Complex
KP2	Log production grade 2 by Complex
KP3	Log production grade 3 by Complex
PE1	Selling grade 1 logs to PESAMA from Concession complex
PE1B	Selling grade 1 logs to PESAMA from outside Concession
PE2	Selling grade 2 logs to PESAMA from Concession complex.
PE2B	Selling grade 2 logs to PESAMA from outside Concession
PE3	Selling grade 3 logs to PESAMA from Concession complex
PE3B	Selling grade 3 logs to PESAMA from outside Concession
BE1	Selling grade 1 logs to PESAKA from Concession complex
BE1B	Selling grade 1 logs to PESAKA from outside Concession complex.
BE2	Selling grade 2 logs to PESAKA from Concession Complex.
BE2B	Selling grade 2 logs to PESAKA from outside Concession Complex
BE3	Selling grade 3 logs to PESAKA from Concession Complex.
BE3B	Selling grade 3 logs to PESAKA from outside Concession complex)
FY1	Selling grade 1 logs to PERMINT from Concession complex..
FY1B	.Selling grade 1 logs to PERMINT from outside Concession complex)
FY2	Selling grade 2 logs to PERMINT from COMPLEX Concession
FY2B	Selling grade 2 logs to PERMINT from outside Complex Concession
FY3	Selling grade 3 logs to PERMINT from KPKKT Concession
FY3B	Selling grade 3 logs to PERMINT from outside Complex Concession

Note: Complex – Timber concession Complex..

RESULTS AND DISCUSSION

a) The expected net farm income

From the analysis, Timber Concession Complex could get net return of about RM 32,857,500 if it only sells logs from her own concession area to her subsidiaries companies. However, if Timber Concession Complex acts as the sole log distributor for all the mills within the holding company, the net profit could be increased up to RM 34,355,300. An increased by RM 1,497,800 per year as expected (Table 6). It is an increased by 4.6% of net return.

b) The quantity of logs required from outside by Grade.

Based on the previous Pre-F inventory record, Timber Concession Complex's has found that it can only supply about 90,000m^3 of logs per year. The first run of LP has managed to allocate the logs to the various mills and at the same time to maximize the net income. LP has allocated 7,000 m^3 Grade 1 and 1,000 m^3 Grade 2 logs to Pesama mill; 18,000m^3 Grade 1 and 9,000 m^3 Grade 2 logs to Pesaka_mill; and 30,000 m^3 Grade 2 and 25,000 m^3 Grade 3 logs to Permint mill (Table 6). However, the total requirement of logs for all the subsidiaries mills were estimated at 131,000 m^3. The balance of logs required estimated 41,000 m^3 must be purchased by Timber Concession Complex from open market and than resell back to the processing mills.

LP matrix has been developed in solving this problem. The result shows that Timber Concessions Complex is required to purchase additional 10,500 m^3 Grade 1, 7,750 m^3 Grade 2 and 22,750 m^3 Grade 3 logs in order to cope with the demand for all the subsidiaries mills at the market price.

Using LP, these quantity has been resell back 10,500 m^3 Grade 1, 7,750 m^3 Grade 2 and 8,750 m^3 Grade 3 to Pesama mill; 9,000 m^3 Grade 3 to Pesaka; and 5,000 m^3 Grade 3 to Permint mill (Table 6).

Table 6: The result of analysis if supply solely from Timber complex vs supply Timber Concessionaires Complex plus buying from out side

Bil.	Items	Grade	Unit	Supply of Timber Concessions Complex Plus Buying (Purchasing) from Outside	Supply from Timber Concessions Complex Only	Differences (+/-)
	Income					
1	Net Farm Income		RM	34,355,300	32,857,500	1,497,800
	Log Supply					
2	Pesama Sdn Bhd	1	M^3	17,500	7,000	10,500
3	Pesama Sdn Bhd	2	M^3	8,750	1,000	7,750
4	Pesama Sdn Bhd	3	M^3	8,750		8,750
5	Pesaka Sdn Bhd	1	M^3	18,000	18,000	0
6	Pesaka Sdn Bhd	2	M^3	9,000	9,000	0
7	Pesaka Sdn Bhd	3	M^3	9,000		9,000
8	Permint Plywood Sdn Bhd	2	M^3	30,000	30,000	0
9	Permint Plywood Sdn Bhd	3	M^3	30,000	25,000	5,000
	Total			131,000	90,000	41,000

c) The Additional funding required with and without buying logs from outside.

The result shows that the Timber Concession Complex requires RM 18,722,500 additional cost in order to purchase extra 41,000 m^3 to met the requirement needed to all the subsidiaries mills. Out of these, the Timber Concession Complex is required to allocate RM7,476,000 for Grade 1, RM3,898,250 for Grade 2 and RM7,348,250 for Grade 3 logs (Table 7). Only under this condition when all these requirement are met , then all the mills would be able to run at the optimal level for the whole year and at the same time maximizing their net return.

Table 7: The additional funding required annually by the timber complex's to purchase the additional logs from open market

No	Type of Logs	Quantity m3	Price RM/m3*	Additional Cost (RM)
1	Grade 1	10,500	712	7,476,000
2	Grade 2	7,750	503	3,898,250
3	Grade 3	22,750	323	7,348,250
	TOTAL	41,000		18,722,500

* Buying market price.

CONCLUSION

LP applications is a very useful tools for solving optimization problems. This study emphases on maximizing the net income of the timber complex's in allocating the logs or raw materials from her concession area as well as from other sources to supply a sufficient raw logs to the fellow subsidiaries processing mills under the same holding company. LP shows also indicates that, The Timber Complex's could optimize the log distribution according to the mills' requirement with the main objective to maximizing the net income. Based on the result of the study, The Timber Complex's can increase their net income by RM 1.5 million annually. Beside that, the study also indicates how logs can be distributed efficiently to all the mills according to grade and quantity specified.

ACKNOWLEDGEMENTS

We wish to thanks the management of the Kumpulan Pengurusan Kayu Kayan Terengganu Sdn. Bhd., of Bandar Bukit Besi, Dungun, Terengganu especially to M.Yusof bin Ahmad the General Manager of the timber complexes for giving us permission to use the data and other facilities for this study. The assistance from Dr. Abdul Rahim Nik and Salleh Mat is gratefully appreciated. My sincere thanks also goes to Mr Khoo Kean Choon who read through the draft of this research paper. Last but not least, we would like to thank the Director of Techno-Economics Division for his support.

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A) LP OUTPUT WITHOUT BUYING LOGS FROM OUTSIDE KPKKT

LP OPTIMUM FOUND AT STEP 6

OBJECTIVE FUNCTION VALUE

1) 32857500.0

VARIABLE	VALUE	REDUCED COST
KP1	25000.000000	0.000000
KP2	40000.000000	0.000000
KP3	25000.000000	0.000000
PE1	7000.000000	0.000000
PE2	1000.000000	0.000000
PE3	0.000000	0.000000
BE1	18000.000000	0.000000
BE2	9000.000000	0.000000
BE3	0.000000	0.000000
FY2	30000.000000	0.000000
FY3	25000.000000	0.000000
C_GRD_1	0.000000	0.000000
C_GRD_2	0.000000	0.000000
C_GRD_3	0.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
SUP_G1)	0.000000	544.750000
SUP_G2)	0.000000	376.750000
SUP_G3)	0.000000	166.750000
PREM)	2126700.000000	0.000000
PRE_F)	40500.000000	0.000000
TREEMK)	85500.000000	0.000000
BOND)	13500.000977	0.000000
HARVT)	4536900.000000	0.000000
ROYSIL)	2007900.000000	0.000000
CLORPT)	34200.000000	0.000000
POST_F)	54000.003906	0.000000
FORTRET)	118800.007813	0.000000
RDMT)	337500.000000	0.000000
ADMIN)	3357000.000000	0.000000
SELL_G1)	0.000000	-686.000000
SELL_G2)	0.000000	-518.000000
SELL_G3)	0.000000	-308.000000
S_G1PE)	10500.000000	0.000000
S_G2PE)	7750.000000	0.000000
S_G3PE)	8750.000000	0.000000
S_G1BE)	0.000000	0.000000
S_G2BE)	0.000000	0.000000
S_G3BE)	9000.000000	0.000000
S_G2PM)	0.000000	0.000000
S_G3PM)	5000.000000	0.000000
C_GRD1)	0.000000	0.000000
C_GRD2)	0.000000	0.000000
C_GRD3)	0.000000	0.000000

NO. ITERATIONS= 6

RANGES IN, WHICH THE BASIS IS UNCHANGED:

OBJ COEFFICIENT RANGES

VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
KP1	-141.250000	INFINITY	INFINITY
KP2	-141.250000	INFINITY	INFINITY
KP3	-141.250000	INFINITY	INFINITY
PE1	686.000000	0.000000	686.000000
PE2	518.000000	0.000000	518.000000
PE3	308.000000	0.000000	INFINITY
BE1	686.000000	INFINITY	0.000000
BE2	518.000000	INFINITY	0.000000
BE3	308.000000	0.000000	INFINITY
FY2	518.000000	INFINITY	0.000000
FY3	308.000000	INFINITY	0.000000
C_GRD_1	0.000000	0.000000	INFINITY
C_GRD_2	0.000000	0.000000	INFINITY
C_GRD_3	0.000000	0.000000	INFINITY

RIGHTHAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
SUP_G1	25000.000000	10500.000000	7000.000000
SUP_G2	40000.000000	7750.000000	1000.000000
SUP_G3	25000.000000	5000.000000	25000.000000
PREM	0.000000	2126700.000000	INFINITY
PRE_F	0.000000	40500.000000	INFINITY
TREEMK	0.000000	85500.000000	INFINITY
BOND	0.000000	13500.000977	INFINITY
HARVT	0.000000	4536900.000000	INFINITY
ROYSIL	0.000000	2007900.000000	INFINITY
CLORPT	0.000000	34200.000000	INFINITY
POST_F	0.000000	54000.003906	INFINITY
FORTRET	0.000000	118800.007813	INFINITY
RDMT	0.000000	337500.000000	INFINITY
ADMIN	0.000000	3357000.000000	INFINITY
SELL_G1	0.000000	7000.000000	10500.000000
SELL_G2	0.000000	1000.000000	7750.000000
SELL_G3	0.000000	25000.000000	5000.000000
S_G1PE	17500.000000	INFINITY	10500.000000
S_G2PE	8750.000000	INFINITY	7750.000000
S_G3PE	8750.000000	INFINITY	8750.000000
S_G1BE	18000.000000	7000.000000	10500.000000
S_G2BE	9000.000000	1000.000000	7750.000000
S_G3BE	9000.000000	INFINITY	9000.000000
S_G2PM	30000.000000	1000.000000	7750.000000
S_G3PM	30000.000000	INFINITY	5000.000000
C_GRD1	0.000000	0.000000	INFINITY
C_GRD2	0.000000	0.000000	INFINITY
C_GRD3	0.000000	0.000000	INFINITY

B) LP OUPUT WITH BUYING LOGS FROM OUTSIDE KPKKT

LP OPTIMUM FOUND AT STEP 21

OBJECTIVE FUNCTION VALUE

1) 34355300.0

VARIABLE	VALUE	REDUCED COST
BUY_G1	10500.000000	0.000000
BUY_G2	7750.000000	0.000000
BUY_G3	22750.000000	0.000000
KP1	25000.000000	0.000000
KP2	40000.000000	0.000000
KP3	25000.000000	0.000000
PE1	17500.000000	0.000000
PE2	8750.000000	0.000000
PE3	0.000000	0.000000
BE1	7500.000000	0.000000
BE2	9000.000000	0.000000
BE3	0.000000	0.000000
FY2	22250.000000	0.000000
FY3	25000.000000	0.000000
PE1B	0.000000	-0.000031
PE2B	0.000000	0.000000
PE3B	8750.000000	0.000000
BE1B	10500.000000	0.000000
BE2B	0.000000	0.000000
BE3B	9000.000000	0.000000
FY2B	7750.000000	0.000000
FY3B	5000.000000	0.000000
C_GRD_1	7476000.000000	0.000000
C_GRD_2	3898250.000000	0.000000
C_GRD_3	7348250.000000	0.000000

ROW	SLACK OR SURPLUS	DUAL PRICES
SUP_G1)	0.000000	-141.250000
SUP_G2)	0.000000	-141.250000
SUP_G3)	0.000000	-141.250000
PREM)	2126700.000000	0.000000
PRE_F)	40500.000000	0.000000
TREEMK)	85500.000000	0.000000
BOND)	13500.000977	0.000000
HARVT)	4536900.000000	0.000000
ROYSIL)	2007900.000000	0.000000
CLORPT)	34200.000000	0.000000
POST_F)	54000.003906	0.000000
FORTRET)	118800.007813	0.000000
RDMT)	337500.000000	0.000000
ADMIN)	3357000.000000	0.000000
SELL_G1)	0.000000	0.000000
SELL_G2)	0.000000	0.000000
SELL_G3)	0.000000	0.000000
BUY_G1)	0.000000	-712.000000
BUY_G2)	0.000000	-503.000000
BUY_G3)	0.000000	-323.000000
S_G1PE)	0.000000	31.119995
S_G2PE)	0.000000	14.399994
S_G3PE)	0.000000	0.000000
S_G1BE)	0.000000	31.120026
S_G2BE)	0.000000	14.399994
S_G3BE)	0.000000	0.000000
S_G2PM)	0.000000	14.399994

S_G3PM)	0.000000	0.000000
C_GRD1)	0.000000	0.000000
C_GRD2)	0.000000	0.000000
C_GRD3)	0.000000	0.000000
C_PE)	0.000000	25.839996
C_BE)	0.000000	25.839996
C_FY)	0.000000	25.839996
POL1)	0.000000	629.040039
POL2)	0.000000	477.760010
POL3)	0.000000	282.160004

NO. ITERATIONS= 21

RANGES IN WHICH THE BASIS IS UNCHANGED:

OBJ COEFFICIENT RANGES

VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
BUY_G1	-712.000000	712.000000	31.119995
BUY_G2	-503.000000	503.000000	14.399994
BUY_G3	-323.000000	14.399994	INFINITY
KP1	-141.250000	INFINITY	INFINITY
KP2	-141.250000	INFINITY	INFINITY
KP3	-141.250000	INFINITY	INFINITY
PE1	686.000000	INFINITY	-0.000031
PE2	518.000000	INFINITY	0.000000
PE3	308.000000	0.000000	INFINITY
BE1	686.000000	-0.000031	INFINITY
BE2	518.000000	INFINITY	0.000000
BE3	308.000000	0.000000	INFINITY
FY2	518.000000	0.000000	INFINITY
FY3	308.000000	INFINITY	0.000000
PE1B	768.960022	-0.000031	INFINITY
PE2B	543.239990	0.000000	INFINITY
PE3B	348.839996	14.399994	0.000000
BE1B	768.960022	INFINITY	-0.000031
BE2B	543.239990	0.000000	INFINITY
BE3B	348.839996	14.399994	0.000000
FY2B	543.239990	INFINITY	0.000000
FY3B	348.839996	0.000000	INFINITY
C_GRD_1	0.000000	0.000000	0.043708
C_GRD_2	0.000000	0.000000	0.028628
C_GRD_3	0.000000	0.000000	INFINITY

RIGHTHAND SIDE RANGES

ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
SUP_G1	25000.000000	INFINITY	0.000000
SUP_G2	40000.000000	INFINITY	0.000000
SUP_G3	25000.000000	INFINITY	0.000000
PREM	0.000000	2126700.000000	INFINITY
PRE_F	0.000000	40500.000000	INFINITY
TREEMK	0.000000	85500.000000	INFINITY
BOND	0.000000	13500.000977	INFINITY
HARVT	0.000000	4536900.000000	INFINITY
ROYSIL	0.000000	2007900.000000	INFINITY
CLORPT	0.000000	34200.000000	INFINITY
POST_F	0.000000	54000.003906	INFINITY
FORTRET	0.000000	118800.007813	INFINITY
RDMT	0.000000	337500.000000	INFINITY

ADMIN	0.000000	3357000.000000	INFINITY
SELL_G1	0.000000	0.000000	INFINITY
SELL_G2	0.000000	0.000000	INFINITY
SELL_G3	0.000000	0.000000	INFINITY
BUY_G1	0.000000	INFINITY	10500.000000
BUY_G2	0.000000	INFINITY	7750.000000
BUY_G3	0.000000	INFINITY	22750.000000
S_G1PE	17500.000000	7500.000000	0.000000
S_G2PE	8750.000000	8750.000000	0.000000
S_G3PE	8750.000000	INFINITY	0.000000
S_G1BE	18000.000000	9000.000000	0.000000
S_G2BE	9000.000000	9000.000000	0.000000
S_G3BE	9000.000000	INFINITY	0.000000
S_G2PM	30000.000000	5000.000000	0.000000
S_G3PM	30000.000000	INFINITY	0.000000
C_GRD1	0.000000	INFINITY	7476000.000000
C_GRD2	0.000000	INFINITY	3898250.000000
C_GRD3	0.000000	INFINITY	7348250.000000
C_PE	35000.000000	0.000000	8750.000000
C_BE	36000.000000	0.000000	9000.000000
C_FY	60000.000000	0.000000	5000.000000
POL1	25000.000000	0.000000	7500.000000
POL2	40000.000000	0.000000	22250.000000
POL3	25000.000000	0.000000	25000.000000