PAR, Inc.
golf bag manufacturing

Interpretation of the dual variables

using parametric analysis of right-hand-sides.

Consider again the LP model of **PAR, Inc**., which manufactures standard and deluxe golfbags:

X1 = number of **STANDARD** golf bags manufactured per quarter

X2 = number of **DELUXE** golf bags manufactured per quarter

Four operations are required, with the time per golf bag as follows:

OPERATION	STANDARD	DELUXE	Available
Cut-&-Dye	0.7 hr	1.0 hr	630 hrs.
Sew	0.5 hr	0.8666 hr	600 hrs.
Finish	1.0 hr	0.6666 hr	708 hrs.
Inspect-&-Pack	0.1 hr	0.25 hr	135 hrs.
Profit ($/bag)	$10	$9	

```
MAX 10 X1 + 9 X2
ST
 0.7 X1 + X2 <= 630
 0.5 X1 + 0.866666 X2 <= 600
     X1 + 0.666666 X2 <= 708
 0.1 X1 + 0.25 X2 <= 135
END
```

LINDO

```
        OBJECTIVE FUNCTION VALUE
        1)      7668.001

 VARIABLE        VALUE          REDUCED COST
      X1        540.000305        0.000000
      X2        251.999771        0.000000


     ROW    SLACK OR SURPLUS      DUAL PRICES
      2)         0.000000          4.375009
      3)       111.600197          0.000000
      4)         0.000000          6.937494
      5)        18.000025          0.000000
```

```
RANGES IN WHICH THE BASIS IS UNCHANGED:
```

	OBJ COEFFICIENT RANGES		
VARIABLE	CURRENT COEF	ALLOWABLE INCREASE	ALLOWABLE DECREASE
X1	10.000000	3.500014	3.700000
X2	9.000000	5.285714	2.333340

	RIGHTHAND SIDE RANGES		
ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
2	630.000000	52.363735	134.399994
3	600.000000	INFINITY	111.600197
4	708.000000	192.000000	128.000305
5	135.000000	INFINITY	18.000025

Slide (page 5)

Row Parametrics . . .

Parametric Row:
```
2
2
3
4
5
```

OK
Cancel
Help

Report Types
- ☑ Text
- ☑ Graphics

Graph Type
- ⦿ 2D
- ○ 3D

Type: < =

New RHS Value:
```
800
```
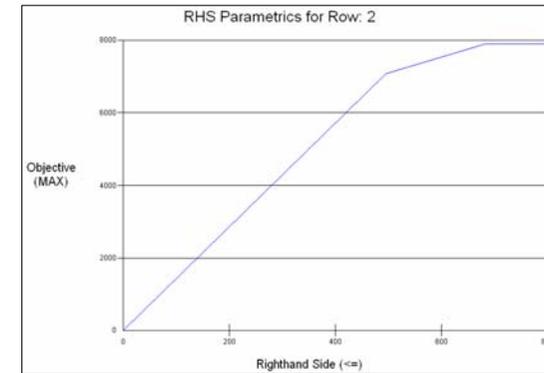
The right-hand-side of the first constraint (row#2) is varied from zero to 800, while the others are *fixed at their original values*.
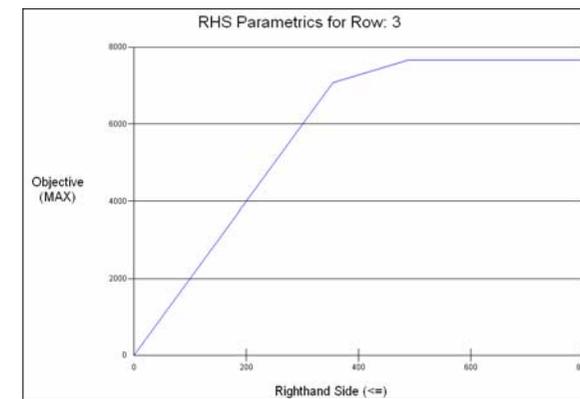
Slide (page 6)

RHS Parametrics for Row: 2

RIGHTHANDSIDE PARAMETRICS REPORT FOR ROW: 2

VAR OUT	VAR IN	PIVOT ROW	RHS VAL	DUAL PRICE BEFORE PIVOT	OBJ VAL
			0.000	14.2857	0.00
SLK 4	X2	2	495.600	14.2857	7080.00
SLK 5	SLK 2	5	682.364	4.37501	7897.09
			800.000	0.00000	7897.09

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RHS Parametrics for Row: 2
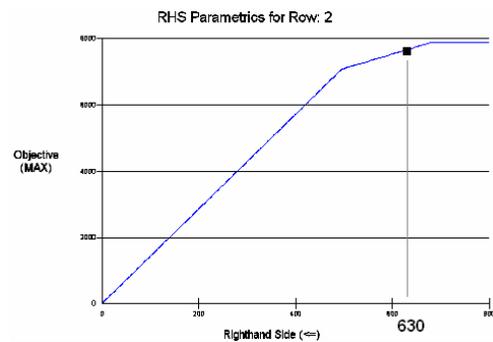
Slope is $4.375/hour at this point!

ROW	SLACK OR SURPLUS	DUAL PRICES
2)	0.000000	**4.375009**

		RIGHTHAND SIDE RANGES	
ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
2	630.000000	52.363735	134.399994

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RHS Parametrics for Row: 3

RIGHTHANDSIDE PARAMETRICS REPORT FOR ROW: 3

VAR OUT	VAR IN	PIVOT ROW	RHS VAL	DUAL PRICE BEFORE PIVOT	OBJ VAL
			0.000	20.0000	0.00
SLK 4	2	4	354.000	20.0000	7080.00
SLK 2	SLK 3	2	488.400	4.3750	7668.00
			800.000	0.0000	7668.00

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RHS Parametrics for Row: 3
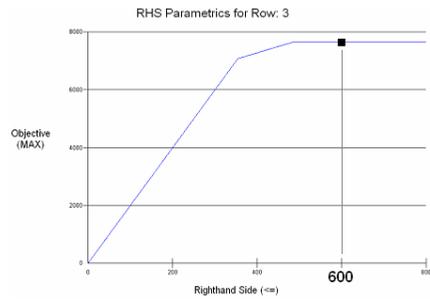
Slope is zero at this point!

ROW	SLACK OR SURPLUS	DUAL PRICES
3)	111.600197	0.000000

	RIGHTHAND SIDE RANGES		
ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
2	630.000000	52.363735	134.399994
3	600.000000	INFINITY	111.600197

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RHS Parametrics for Row: 4
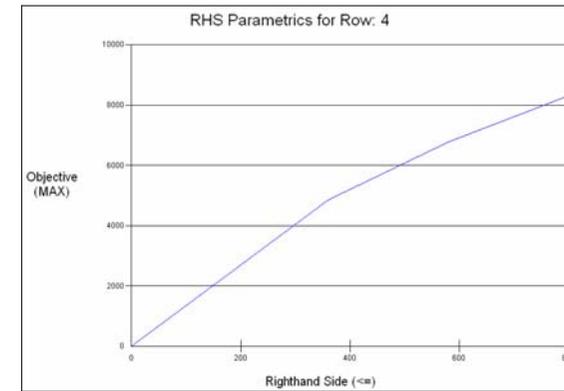
RIGHTHANDSIDE PARAMETRICS REPORT FOR ROW: 4

VAR OUT	VAR IN	PIVOT ROW	RHS VAL	DUAL PRICE BEFORE PIVOT	OBJ VAL
			0.000	13.5000	0.00
SLK 5	X1	5	360.000	13.5000	4860.00
SLK 2	SLK 5	2	580.000	8.72727	6780.00
			800.000	6.93749	8306.25

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RHS Parametrics for Row: 4
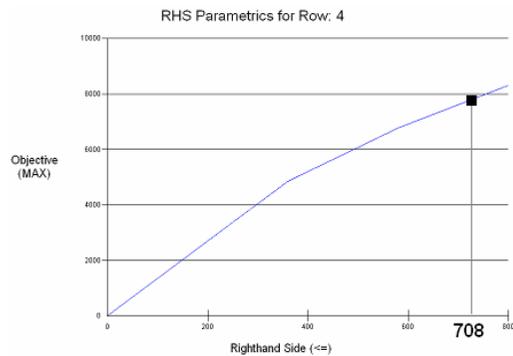
The slope is $6.937/hour at this point.

ROW	SLACK OR SURPLUS	DUAL PRICES
4)	0.000000	6.937494

	RIGHTHAND SIDE RANGES		
ROW	CURRENT RHS	ALLOWABLE INCREASE	ALLOWABLE DECREASE
2	630.000000	52.363735	134.399994
3	600.000000	INFINITY	111.600197
4	708.000000	192.000000	128.000305

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RHS Parametrics for Row: 5
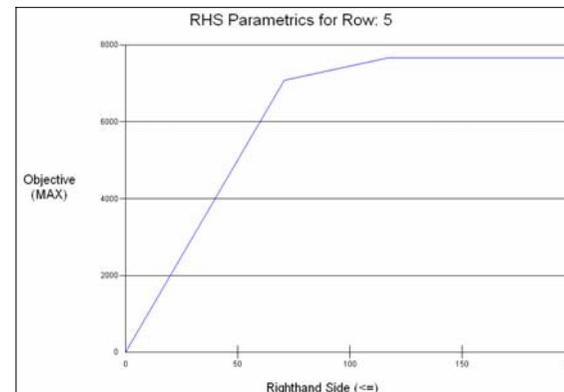
RIGHTHANDSIDE PARAMETRICS REPORT FOR ROW: 5

VAR OUT	VAR IN	PIVOT ROW	RHS VAL	DUAL PRICE BEFORE PIVOT	OBJ VAL
			0.000	100.000	0.00
SLK 4	X2	4	70.8000	100.000	7080.00
SLK 2	SLK 5	2	117.000	12.727	7668.00
			200.000	0.000	7668.00

RHS Parametrics for Row: 5

Objective
(MAX)

Righthand Side (<=)

135
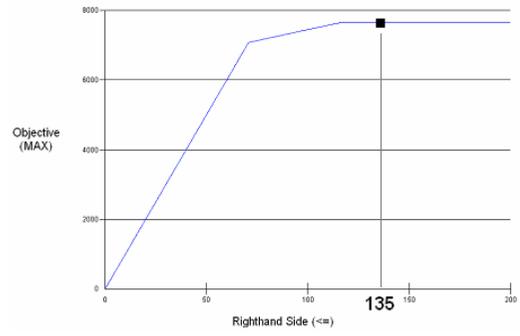
Slope is zero at this point!

```
ROW     SLACK OR SURPLUS     DUAL PRICES
 5)          18.000025           0.000000
```

```
                  RIGHTHAND SIDE RANGES
ROW          CURRENT          ALLOWABLE          ALLOWABLE
               RHS             INCREASE           DECREASE
 5         135.000000          INFINITY          18.000025
```