

\$online

/\*

*GAMS program used to estimate technical efficiency, using a directional distance function model.  
The directional distance function seeks to simultaneously expand outputs and contract inputs.  
This version imposes Variable Returns to Scale*

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*References: Fare, R. and S. Grosskopf. 2000. "Theory and Application of Directional Distance Functions." Journal of Productivity Analysis, 13:93-103.*

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*/\* The following line turns off listing of some elements in the GAMS listing file\*/*

\$OFFSYMLIST OFFSYMXREF OFFUELLIST OFFFUELXREF

OPTION SOLPRINT=OFF, SYSOUT=OFF, LIMROW=0, LIMCOL=0;

*/\*NEXT DEFINE INPUTS AND OUTPUTS\*/*

SET INOUT /out1\*out6, fix1\*fix3, var1, var2/

OUTPUT(INOUT) /out1\*out6/

INPUT(INOUT) /fix1\*fix3, var1, var2/

OBS /1\*200/

SUBOBS(OBS) /1\*82/

ACTOBS(OBS)

*/\*We have allocated enough memory for 200 observations, but our data set only contains 82 observations (subobs)\*/*

;

*/\*Next, define an alias for the set SUBOBS\*/*

alias (subobs, subobs1)

*/\* The include statement below reads in an external data file which contains a table of observations, inputs and outputs. The file is in comma separated value format (CSV) which can be written from, and read into spreadsheet programs*

*The offlisting command means that the data won't be included in the listing file.*

\*/

\$OFFLISTING

TABLE ACT(OBS,INOUT) INPUT OUTPUT TABLE

\$ondelim

\$INCLUDE "cap1.csv"

\$offdelim

\$ONLISTING

PARAMETER

score1(obs) efficiency scores  
;

VARIABLES

Beta efficiency score  
weight(obs) weights;

POSITIVE Variable weight;

EQUATIONS

CONSTR1(OUTPUT, OBS) DEA constraint for each output  
CONSTR2(INPUT,OBS) DEA Constraint for calculating TE  
CONSTR3 DEA Constraint for VRS;

CONSTR1(OUTPUT, ACTOBS).. SUM(SUBOBS,WEIGHT(SUBOBS)\*ACT(SUBOBS,OUTPUT))  
=G= (1+beta)\*ACT(ACTOBS, OUTPUT);

CONSTR2(INPUT, ACTOBS).. SUM(SUBOBS,WEIGHT(SUBOBS)\*ACT(SUBOBS,INPUT))  
=L=(1-Beta)\*ACT(ACTOBS,INPUT);

CONSTR3.. SUM(SUBOBS, WEIGHT(SUBOBS)) =E= 1;

*/\*Define a parameter to hold results for each pass through the loop\*/*

*/\*Define an external file to hold results which tell whether model solved  
at each iteration\*/*

file primal /te\_res.txt/;

MODEL TE /ALL/;

te.solprint=2; */\*Turn off writing results to solution file\*/*  
te.solvelink=2; */\*Keep model in memory. Improves solution time\*/*

LOOP(SUBOBS1,

```

ACTOBS(OBS)=NO;
ACTOBS(SUBOBS1)=YES;

SOLVE TE maximizing Beta USING LP;

score1(subobs1)=Beta.l;

put primal;

if ((te.modelstat eq 1 and te.solvestat eq 1),
    put @1, subobs1.tl, @10, "optimal", @20, "normal completion" /
else
    put @1, subobs1.tl, @10, te.modelstat:>2:0,
        @20, te.solvestat:>2:0/
);

);

/*The next file is to output results to a file to be imported into a spreadsheet program.
Results could also be printed to the listing file with the use of the display command*/

file res /"dd_te_vrs.csv"/ ;

res.pc=5;
res.pw=200;

put res;

put 'Obs', 'Beta',

put /

loop (subobs1,
    put /
    put subobs1.tl, score1(subobs1),
);
putclose;

```