Price Endogenous Example

Dhazn Gillig
&
Bruce A. McCarl

Department of Agricultural Economics
Texas A&M University

$$\begin{array}{llllll} \text{Max} & \boxed{a_d}\, Q_d - 1/2\, \boxed{b_d}\, Q_d^2 & - \boxed{a_s}\, Q_s - 1/2\, \boxed{b_s}\, Q_s^2 & & \\ \text{s.t.} & Q_d & - Q_s & \le & 0 \\ & Q_d\,, & \quad Q_s & \ge & 0 \end{array}$$

```
SETS    CURVEPARM  CURVE PARAMETERS  /INTERCEPT,SLOPE/
        CURVES     TYPES OF CURVES   /DEMAND,SUPPLY/

TABLE   DATA(CURVES,CURVEPARM) SUPPLY DEMAND DATA

              INTERCEPT    SLOPE
DEMAND            6        -0.30
SUPPLY            1         0.20

PARAMETERS  SIGN(CURVES)  SIGN ON CURVES IN OBJECTIVE FUNCTION
            /SUPPLY -1,  DEMAND 1/

POSITIVE VARIABLES  QUANTITY(CURVES)   ACTIVITY LEVEL
VARIABLES           OBJ                NUMBER TO BE MAXIMIZED

EQUATIONS        OBJJ                  OBJECTIVE FUNCTION
                 BALANCE               COMMODITY BALANCE;

OBJJ..   OBJ  =E=
           SUM(CURVES,
                SIGN(CURVES)
                  * (        DATA(CURVES,"INTERCEPT")*QUANTITY(CURVES)
                      + 0.5*DATA(CURVES,"SLOPE")*QUANTITY(CURVES)**2)      ) ;

BALANCE..   SUM(CURVES, SIGN(CURVES)*QUANTITY(CURVES)) =L= 0 ;

MODEL PRICEEND /ALL/ ;
SOLVE PRICEEND USING  NLP  MAXIMIZING OBJ ;c
```

Create the data
a_d, b_d, a_s, b_s
suppose:
Pd = 6 – 0.3Qd
Ps = 1 + 0.2Qs

Actually we can write OBJJ.. Equation as follows:

```
OBJJ..   OBJ  =E=
        DATA("Demand","INTERCEPT")*QUANTITY("Demand")
            +  0.5*DATA("Demand","SLOPE")*QUANTITY("Demand")**2
      - DATA("Supply ","INTERCEPT")*QUANTITY("Supply ")
            -  0.5*DATA("Supply ","SLOPE")*QUANTITY("Supply ")**2          ;
```

But it is not an efficient way to do so.
Below is the better way to write this equation. But the problem is that signs for a demand or a supply are different. It should be + for a demand curve and – for a supply curve.

????

```
OBJJ..   OBJ  =E=
    sum(Curve, +/- DATA(Curve,"INTERCEPT")*QUANTITY(Curve)
               +/- 0.5*DATA(Curve,"SLOPE")*QUANTITY(Curve)**2       )  ;
```

So, we use a SIGN parameter to do the trick

```
OBJJ..   OBJ  =E=
     sum(Curve,  sign(Curve)* (      DATA(Curve,"INTERCEPT")*QUANTITY(Curve)
                                  +  0.5*DATA(Curve,"SLOPE")*QUANTITY(Curve)**2  )
          )  ;
```

RECALL
```
PARAMETERS  SIGN(CURVES)  SIGN ON CURVES IN OBJECTIVE FUNCTION
                /SUPPLY -1,  DEMAND 1/
```