ResEco - formulas

Mr Green Pepper

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1 base formulas

supplier max $\sum_{region} Q_{sell}(supplier, region) * \Big(price(region) - C_{trans}(supplier, region)\Big)$

$-Q_{prod}(supplier) * C_{prod}(region)$

$$\forall supplier$$

s.t. general constraint logic:

”

$\sum_{region} Q_{sell}(supplier, region) \leq transCap(supplier, region) \leq Q_{prod}(supplier) \leq$

$productionCap$

$\forall\ supplier, regions$

”

$\rightarrow$

$$Q_{sell}(supplier, region) \leq transCap(supplier, region)$$

$$\sum_{region} Q_{sell}(supplier, region) \leq\ Q_{prod}(supplier)$$

$$Q_{prod}(supplier) \leq ProdCap(supplier)$$

split into constraints:

$$0 \leq \ Q_{sell}(supplier, region) \leq transCap(supplier, region)$$

$$0 \leq \ \sum_{region} Q_{sell}(supplier, region) \leq \ Q_{prod}(supplier)$$

$$0 \leq \ Q_{prod}(supplier) \leq ProdCap(supplier)$$

for gams:

1. split
2. ≤ 0 & $define\ \mu$'s

   1.transCap

$$0 \leq Q_{sell}(supplier, region)$$

$$Q_{sell}(supplier, region) \leq transCap(supplier, region)$$

2.transCap

$$-Q_{sell}(supplier, region) \leq 0 \perp \ \mu_{transCapLow}$$

$$Q_{sell}(supplier, region) - transCap(supplier, region) \leq 0 \perp \ \mu_{transCapUp}$$

   1.sellCap

$$0 \leq \ \sum_{region} Q_{sell}(supplier, region)$$

$$\sum_{region} Q_{sell}(supplier, region) \leq Q_{prod}(supplier)$$

2.sellCap

$$-\sum_{region} Q_{sell}(supplier, region) \leq 0 \perp \ \mu_{sellCapLow}$$

$$\sum_{region} Q_{sell}(supplier, region) - Q_{prod}(supplier) \leq 0 \perp \ \mu_{sellCapUp}$$

1.prodCap

$$0 \leq \ Q_{prod}(supplier)$$

$$Q_{prod}(supplier) \leq ProdCap(supplier)$$

2.prodCap

$$-Q_{prod}(supplier) \leq 0 \perp \ \mu_{prodCapLow}$$

$$Q_{prod}(supplier) \leq ProdCap(supplier) \perp \ \mu_{prodCapUp}$$

lagrange for gams:

$max \sum_{region} Q_{sell}(supplier, region) * \Big(price(region) - C_{trans}(supplier, region)\Big)$

$-Q_{prod}(supplier) * C_{prod}(region) \ \forall \ supplier$

→ **chang max to min:**

$min \sum_{region} Q_{sell}(supplier, region) * \Big(C_{trans}(supplier, region) - price(region)\Big)$

$+Q_{prod}(supplier) * C_{prod}(region) \ \forall \ supplier$

→ **add constraints:**

$-Q_{sell}(supplier, region) \leq 0 \perp \ \mu_{transCapLow}$

$\rightarrow -\mu_{transCapLow} * Q_{sell}(supplier, region)$

$Q_{sell}(supplier, region) - transCap(supplier, region) \leq 0 \perp \ \mu_{transCapUp}$

$\rightarrow \mu_{transCapUp} * \Big(Q_{sell}(supplier, region) - transCap(supplier, region)\Big)$

$-\sum_{region} Q_{sell}(supplier, region) \leq 0 \perp \ \mu_{sellCapLow}$

$\rightarrow -\mu_{sellCapLow} * \sum_{region} Q_{sell}(supplier, region)$

$\sum_{region} Q_{sell}(supplier, region) - Q_{prod}(supplier) \leq 0 \perp \ \mu_{sellCapUp}$

$\rightarrow \mu_{sellCapUp} * \Big(\sum_{region} Q_{sell}(supplier, region) - Q_{prod}(supplier) \Big)$

$-Q_{prod}(supplier) \leq 0 \perp \ \mu_{prodCapLow}$

$\rightarrow -\mu_{prodCapLow} * Q_{prod}(supplier)$

$Q_{prod}(supplier) - ProdCap(supplier) \leq 0 \perp \ \mu_{prodCapUp}$

$\rightarrow \mu_{prodCapUp} * \Big((Q_{prod}(supplier) - ProdCap(supplier)) \Big)$

gams obj for supplier (Q_{sell})

$\frac{\partial f}{\partial Q_{sell}} \sum_{region} Q_{sell}(supplier, region) * \Big(C_{trans}(supplier, region) - price(region) \Big)$

$+Q_{prod}(supplier) * C_{prod}(region)$

$-\mu_{transCapLow} * Q_{sell}(supplier, region)$

$+\mu_{transCapUp} * \Big(Q_{sell}(supplier, region) - transCap(supplier, region) \Big)$

$-\mu_{sellCapLow} * \sum_{region} Q_{sell}(supplier, region)$

$+\mu_{sellCapUp} * \Big(\sum_{region} Q_{sell}(supplier, region) - Q_{prod}(supplier) \Big)$

$-\mu_{prodCapLow} * Q_{prod}(supplier)$

$+\mu_{prodCapUp} * \Big(Q_{prod}(supplier) - ProdCap(supplier) \Big)$

$=$

$\sum_{region} C_{trans}(supplier, region) - price(region)$

$-\mu_{transCapLow}$

$+\mu_{transCapUp}$

$-\sum_{region} \mu_{sellCapLow}$

$+\sum_{region} \mu_{sellCapUp}$

gams obj for supplier (Q_{prod}):

$\frac{\partial f}{\partial Q_{prod}} \sum_{region} Q_{sell}(supplier, region) * \Big(C_{trans}(supplier, region) - price(region) \Big)$

$+Q_{prod}(supplier) * C_{prod}(region)$

$-\mu_{transCapLow} * Q_{sell}(supplier, region)$

$+\mu_{transCapUp} * \Big(Q_{sell}(supplier, region) - transCap(supplier, region) \Big)$

$-\mu_{sellCapLow} * \sum_{region} Q_{sell}(supplier, region)$

$+\mu_{sellCapUp} * \Big(\sum_{region} Q_{sell}(supplier, region) - Q_{prod}(supplier) \Big)$

$-\mu_{prodCapLow} * Q_{prod}(supplier)$

$+\mu_{prodCapUp} * \Big(Q_{prod}(supplier) - ProdCap(supplier) \Big)$

$=$

$+C_{prod}(region)$

$-\mu_{sellCapUp}$

$-\mu_{prodCapLow}$

$+\mu_{prodCapUp}$