ResEco - formulas

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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:

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

$productionCap$

$\forall \, supplier, regions$

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

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

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

split into constraints:

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

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

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

for gams:

1. split

2. $\leq 0\ \&\ define\ \mu$'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

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

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

2.sellCap

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

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

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:

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

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

$\rightarrow$ **chang max to min:**

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

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

$\rightarrow$ **add constraints:**

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

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

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

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

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

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

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

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

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

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

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

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

gams obj for supplier (Q_{sell})

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

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

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

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

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

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

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

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

$$=$$

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

$$- \mu_{transCapLow}$$

$$+ \mu_{transCapUp}$$

4

$-\mu_{sellCapLow}$

$+\mu_{sellCapUp}$

gams obj for supplier (Q_{prod}):

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

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

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

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

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

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

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

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

$=$

$+C_{prod}(region)$

$-\mu_{sellCapUp}$

$-\mu_{prodCapLow}$

$+\mu_{prodCapUp}$