Agricultural Economics and Policy: Practical #2

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This is an exercise to construct a trade model in GAMS. Go to the 'Trade' tab on the website and there are two readings – spatial economics in GAMS and calibration of trade models. These might prove useful as a guide.

Phase 1

The parameters of the demand and supply curves for three regions (A, B and C) are provided in the table below. Also provided is a grid of transportation (shipping & handling) costs. Note that region A exports everything that it produces because it has no domestic consumers. Conversely, B imports everything that it consumes because it has no domestic producers. Region C, which is a producer and consumer, could be a net importer or a net exporter.

Solve for the spatial trade equilibrium using GAMS. If you would prefer to use Excel, you will need to first set up the problem (e.g., one cell will have a formula giving the area under demand as a function of the cell containing the region's 'yet-to-be-determined' demand quantity).

The objective is to maximize the sum of the areas under the three demand functions minus the sum of the areas under the supply functions and minus the sum of the shipping & handling costs (equation 4 in first reading above). Let *s* refer to a supply region and *d* a demand region, with *s*=*d* possible. The constraints are:

(1) $\sum_{s=1}^{S} q_{s,d} \geq q_d$, $\forall d$. Supply reaching a region ≥ demand in that region

(2) $\sum_{d=1}^{D} q_{s,d} \leq q_s$, $\forall\, s$. Demand for a region's goods ≤ supply provided by that region

(3) All $q_{s,d}$ (trade from region *s* to region *d*, including itself), q_s and $q_d \geq 0$.

(NOTE: Constraints (1) and (2) are shown in equation 3 in the above reading.)

You can either choose to solve for the set of inter-regional shipments to maximize net aggregate welfare and then recover the set of equilibrium prices. Alternatively, you can choose the three prices in the three regions to ensure that the law-of-one-price relationships are not violated and total exports equal total imports.

Demand, supply and unit shipping & handling cost parameters

	Demand		Supply			Unit transport cost ($/tonne)		
Country	*Intercept*	*Slope*	*Intercept*	*Slope*	*Country*	*A*	*B*	*C*
A	0	0	2	0.5	A	0	2	3
B	100	2	0	0	B	2	0	4
C	75	1	5	0.75	C	3	4	0

What output to provide?

1. $q_{s,d}$ (inter-regional shipments),
2. q_s and q_d, i.e., the total supply and demand in each region
3. Prices in each region
4. Producer and consumer surpluses.

Phase 2

Go to the 'trade' tab and download the 'Base lumber trade model'. This is a global lumber trade model with 20 regions. All of the data is found in various GAMS 'data' files. Begin with the basic model, and determine the bi-lateral trade flows and welfare implications.

Then examine the inter-regional trade flows and how the model is calibrated. What does the calibration entail and what changes do you have to make to re-run the model? What is the difference between the uncalibrated and calibrated models? How big a difference does calibration make?