Defining Supply and Demand Equations – Private Goods[1]
In-Class Problem[2]

Suppose the US market for Grits is represented by the follow schedule with quantities presented in millions:

Price	*Quantity*$_S^{US}$	*Quantity*$_D^{US}$
$2	5	12
$3	10	10

a) Provide a completed Supply and Demand Schedules extended to the point where Quantity$_D^{US}$ = 0 and Quantity$_S^{US}$ = 0.

Price	*Quantity*$_S^{US}$	*Quantity*$_D^{US}$
$1	0	14
$2	5	12
$3	10	10
$4	15	8
$5	20	6
$6	25	4
$7	30	2
$8	35	0

b) Identify the Inverse Demand and Inverse Supply Equations for this market.

Inverse Supply: $\qquad P = 1 + \frac{1}{5} Q_S^{US}$

Inverse Demand: $\qquad P = 8 - \frac{1}{2} Q_D^{US}$

c) What are the Demand and Supply Equations for this market?

From Inverse Supply: $P = 1 + \frac{1}{5} Q_S^{US}$ we rearrange the equation normalized to Q_S^{US} such that

$\frac{1}{5} Q_S^{US} = P - 1 \longrightarrow Q_S^{US} = 5P - 5$ = Supply Equation

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From Inverse Demand: $P = 8 - \frac{1}{2} Q_D^{US}$ we rearrange the equation normalized to Q_D^{US} such that

$$\frac{1}{2} Q_D^{US} = 8 - P \quad \longrightarrow \quad Q_D^{US} = 16 - 2P$$

d) Based on the Supply and Demand Equations, what are the equilibriating values for price and quantity for this market?

$$Q_D^{US} = Q_S^{US}$$

5P – 5 = 16-2P $Q_D^{US} = Q^* = 5(3) - 5 = 10$

7P = 21

P* = 3

Now suppose that there is also a demand market for Grits in Canada represented by the following schedule:

Price	Quantity$_D^C$
$4	12
$5	9

e) What is the Demand Equation for the Canadian market for Grits?

Price	Quantity$_D^C$
$4	12
$5	9
$6	6
$7	3
$8	0

$P = 8 - \frac{1}{3} Q_D^C$ Inverse Demand

$$\frac{1}{3} Q_D^C = 8 - P$$

$Q_D^C = 24 - 3P$ Demand Equation

f) Provide an Aggregate Demand Equation for the North American market for Grits by summing the Canadian and US Demand Equations.

$$Q_D^C = 24 - 3P$$
$$Q_D^{US} = 16 - 2P$$

$$\overline{Q_D^{US} + Q_D^C = 16 - 2P + 24 - 3P}$$

$$Q_D = 40 - 5P$$

g) Show how you would confirm that this equation is accurate by forming an Aggregate Demand Schedule then forming an Aggregate Demand Equation based on that schedule.

Price	*Quantity*$_S^{US}$	*Quantity*$_D^{US}$ +	*Quantity*$_D^C$	=	*Quantity*$_D$
$1	0	14	21		35
$2	5	12	18		30
$3	10	10	15		25
$4	15	8	12		20
$5	20	6	9		15
$6	25	4	6		10
$7	30	2	3		5
$8	35	0	0		0

$$P = 8 - \frac{1}{5}Q_D$$
$$\frac{1}{5}Q_D = 8 - P$$
$Q_D \; 40 - 5P$ which is the Demand Equation and is the same found above

h) What are the equalibriating values for price and quantity for the North American Market?

$$Q_D = Q_S$$
$$40 - 5P = 5P - 5$$
$$10P = 45$$
$$P^* = 4\frac{1}{2}$$

$$Q_S = Q^* = 5P - 5$$

$$Q^* = 5\left(4\frac{1}{2}\right) - 5$$

$Q^* = 22\frac{1}{2} - 5 = 17\frac{1}{2}$ which matches up with a visual observation of the equilibrating values from the schedule above

i) **What are the quantities demanded by the US and Canadian markets and how do these relate to the aggregate demand quantity?**

At a price for the North American market of $4½ we can determine the quantities the US and Canada will each demand by plugging that price into each market's demand equation:

$$Q_D^C = 24 - 3P$$
$$Q_D^C = 24 - 3\left(4\frac{1}{2}\right) = 10\frac{1}{2}$$

$$Q_D^{US} = 16 - 2P$$
$$Q_D^{US} = 16 - 2\left(4\frac{1}{2}\right) = 7$$

$$Q_D^C + Q_D^{US} = 17\ ½$$

This reconciles nicely with the Q* for the North American market since

$$Q_D^C + Q_D^{US} = Q_D^{NA} = Q^* = 17\frac{1}{2}$$