Exercise MS-151

Deriving a market supply curve with heterogeneous sellers

The Economic Skills Project

1 Problem

Problem

A market has two types of sellers, A and B. There are 20 type-A sellers and 1 type-B seller. An individual i of each type has a willingness to accept for the good given by the corresponding equation below.

Type A individual $WTA_i^A = 50 + Q_i^A$

Type B individual $WTA_i^B = 50 + \frac{1}{10}Q_i^B$

What is the market supply $Q_M(P^s)$ where P^s is the price received by sellers?

2 Answer

Answer

Here's the solution:

- $Q_M = 30P^s - 1500$

3 Method

Solution method

Here's one approach:

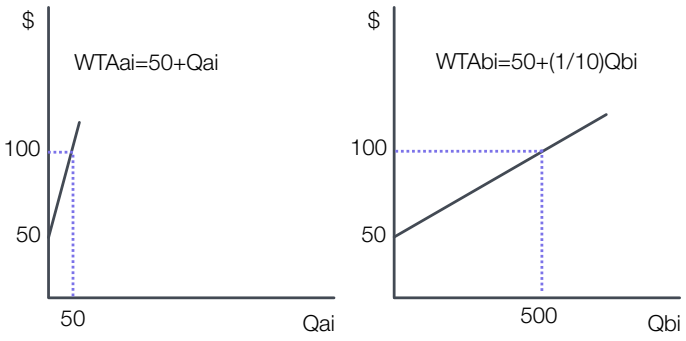
1. Draw graphs of each WTA curve
2. Use the choice rule for a type-A seller
3. Solve for individual supply Q_i^A
4. Repeat to get individual demand Q_i^B
5. Sum over all the individuals
6. Check the result

4 Solution

4.1 Step 1

Draw the WTA graphs

Here's how they look:



4.2 Step 2

Use the choice rule for type-A seller

Seller i of type A facing price P^s chooses Q_i^A where:

- $WTA_i^A = P^s$

Thus for a type-A seller we have two equations and three variables:

1. $WTA_i^A = 50 + Q_i^A$
2. $WTA_i^A = P^s$

By combining the equations we can derive a single equation giving Q_i^A in terms of P^s.

4.3 Step 3

Solving for individual supply Q_i^A

Use the decision rule (equation 2) to eliminate WTA_i^A from the WTA equation (equation 1) and then solve for Q_i^A:

- $P^s = WTA_i^A = 50 + Q_i^A$
- $P^s = 50 + Q_i^A$
- $Q_i^A = P^s - 50$

4.4 Step 4

Solving for individual supply Q_i^B

Follow the same set of steps for a seller of type B:

- $P^s = WTA_i^B = 50 + \frac{1}{10}Q_i^B$
- $P^s = 50 + \frac{1}{10}Q_i^B$
- $\frac{1}{10}Q_i^B = P^s - 50$
- $Q_i^B = 10\,(P^s - 50)$
- $Q_i^B = 10P^s - 500$

4.5 Step 5

Summing over individuals

The market supply, Q_M, is the sum of the individual supplies taking into account the number of sellers of each type. If there are N_A sellers of type A and N_B sellers of type B, it is:

- $Q_M = \sum_{i=1}^{N_A} Q_i^A + \sum_{i=1}^{N_B} Q_i^B$
- $Q_M = N_A Q_i^A + N_B Q_i^B$

Filling in the given numbers of sellers and the supplies derived above:

- $Q_M = 20\,(P^s - 50) + 1(10P^s - 500)$
- $Q_M = 20P^s - 1000 + 10P^s - 500$
- $Q_M = 30P^s - 1500$

4.6 Step 6

Checking the result

The Y intercept of the market supply curve should be consistent with the original WTA curves. Checking:

$P^s = 50$**:** $Q_M = 30(50) - 1500 = 0$

That works!

Checking the X intercept isn't very useful since it's at $P^s = 0$ and neither seller will accept less than \$50. Checking a price above \$50 is more useful and is done on the next page.

Checking, continued

At $P^s = 100$ the market supply would be $Q_M = 30(100) - 1500 = 1500$. Checking the individual supplies:

- $Q_i^A = P^s - 50 = 100 - 50 = 50$
- $Q_i^B = 10P^S - 500 = 1000 - 500 = 500$

Adding up over all of the sellers gives $Q_M = 20(50) + 500 = 1500$.

Everything checks - done!