Supply and Demand in an Exchange Economy

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1 Supply, Demand, and Preference

First, we'll start with a simple assumption. There are two groups. One group has money and wants to buy units of a particular good (these are "demanders"). The other group has the good, and wants to sell it for money (these are "suppliers"). For simplicity, I'll put parentheses around what a particular person doesn't have. To keep it simple, let's just consider one buyer and one seller. The seller has just one unit of the good to sell. Suppose that our buyer and seller have preferences like this:

Buyer:

1. $5
2. (1st unit of water)
3. $4

Seller:

1. $5
2. 1st unit of water
3. $4

Is there any possible trade between these two? Let's consider. Buyer will buy if the water is $4, but not if it is $5. Seller will sell if the water is $5, but not if it is $4. (We're ruling out partial dollars at this point. We could do the whole exercise with them, and make the difference a penny instead of a dollar. The logic would follow through.) So, will any exchange happen? No. Any price that is low enough for Buyer to be willing to buy is too low for Seller to be willing to sell. So, no trade occurs.

This example actually presents an important point: if the buyer and seller have identical preferences between two options, then there is no room for trade. In this case, given the choice between $4 and a unit of water, both Seller and Buyer would choose the water. Given a choice between $5 and water, both Seller and Buyer would choose the money. So, there's no room for trade.

However, if we give Seller an additional unit of water, things can change. For example,

Buyer:

1. $5
2. (1st unit of water)
3. $4
4. (2nd unit of water)
5. $3

Seller:

1. $5
2. 1st unit of water
3. $4
4. 2nd unit of water
5. $3

In this case, there is room for trade. Can you find where?[1]

We can think about this example in supply and demand terms - first thinking in terms of a table.

Price	Demand	Supply
$5	0	2
$4	1	1
$3	2	0

Graphically, we have Figure 1. (In this case, I adopted the convention of a straight line demand curve.)

Is it really that easy? *Yes*, in this example. Here, we have made a number of simplifying assumptions. Among those: buyers have zero units to start, and there is only one buyer and one seller. But, fundamentally, the story doesn't change much when we complicate things. So, let's do a complicated example.

[1] Answer: 1 unit of water will change hands, and will do so for $4. The trick? Buyer's first unit of water is Seller's second unit. So, even though the preferences are identical in some sense, the preference between "a unit of water" and $4 is different.

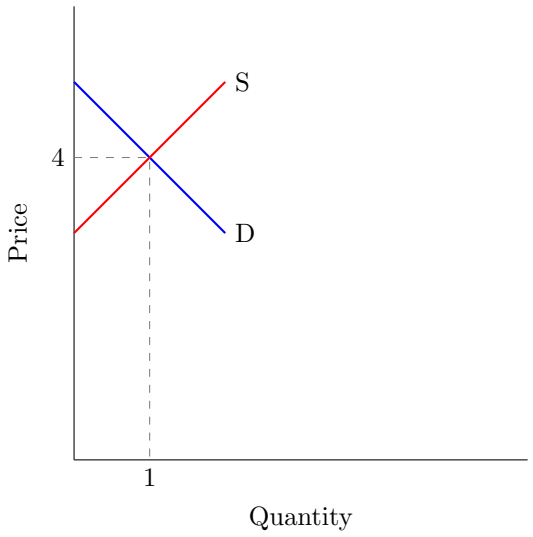

Figure 1: Supply and Demand

2 A Complicated Example

In this example, there are five people. Each has a different number of units of water. As before, parentheses will denote that the person doesn't have that particular good.

Achilles:

1. $7
2. 1st unit of water
3. $6
4. 2nd unit of water
5. $5
6. 3rd unit of water
7. $4
8. 4th unit of water
9. $3
10. (5th unit of water)
11. $2
12. (6th unit of water)

13. $1
14. (7th unit of water)

Beatrice:

1. $10
2. 1st unit of water
3. $9
4. 2nd unit of water
5. $8
6. 3rd unit of water
7. $7
8. (4th unit of water)
9. $6
10. (5th unit of water)
11. $5
12. (6th unit of water)
13. $4
14. (7th unit of water)
15. $3
16. (8th unit of water)
17. $2
18. (9th unit of water)
19. $1
20. (10th unit of water)

Camden:

1. $3
2. 1st unit of water
3. $2
4. (2nd unit of water)

5. $1

Demeter:

1. $1
2. 1st unit of water
3. (2nd unit of water)

Eldon:

1. $10
2. 1st unit of water
3. $9
4. 2nd unit of water
5. $8
6. 3rd unit of water
7. $7
8. (4th unit of water)
9. $6
10. (5th unit of water)
11. $5
12. (6th unit of water)
13. $4
14. (7th unit of water)
15. $3
16. (8th unit of water)
17. $2
18. (9th unit of water)
19. $1

From these we can derive the following Supplies and Demands for Exchange for different prices.

Price	Demanded	Supplied
10	0	10
9	0	9
8	0	8
7	0	6
6	2	5
5	4	4
4	6	3
3	8	2
2	12	1
1	15	1

Here, we'd say that "equilibrium" is at a price of \$5 with 4 units being traded. If we wanted to, we could make a graph of this - but it's not necessary. But, how do we get the numbers in this table? Why do we call this point "equilibrium"?

To get the numbers in the table, we propose a particular price - let's use \$5 - and then see how each person reacts to that price. If the price is \$5, then Achilles chooses to sell 2 of his 4 units of water. How do we know that? Because his preferences dictate that he'd rather have \$5 than his 3rd or his 4th unit of water. But, he'd rather keep his 2nd unit than get \$5 for it. So, he sells 2 units. Beatrice would rather have a 4th and 5th unit of water in addition to the three she already has. We know that because the 4th unit and the 5th unit are each more highly preferred than \$5. However, she won't buy a 6th unit, because she'd rather have \$5 than a 6th unit. So, she buys 2 units. Camden would rather have \$3 than his 1 unit of water - so he'd obviously rather have \$5 than his one unit. So, he sells the one unit that he has. Demeter seems to hate water, as she'd be willing to take \$1 for her one unit of water. So, she'll obviously sell her one unit for \$5. Eldon would like a 4th and 5th unit of water in addition to the three he already has. So, he'll buy two units. Now, we add it up. Beatrice wants to buy two units, as does Eldon. That's a quantity of 4 total being demanded. Achilles sells two units, and Camden and Demeter each sell one unit. That's a total of 4 units. So, the market participants want to buy 4 units and sell 4 units. This is "equilibrium".

Why do we call this "equilibrium"? The concept of equilibrium is one in which there is no tendency for change. In this case, we mean that there's no tendency for a price of \$5 to change. There's good reason to believe that the market will tend toward this price. Suppose, for example, that the price were \$6. In that case, market participants try to sell 5 units, while buyers only want to buy 2 units. In this case, some sellers will be frustrated by their inability to sell. There is an obvious solution: undercut the competition's prices! So, a price of \$6 will tend to fall. At a price of \$4, buyers want to buy 6 units while sellers want to sell 3. Now, we have frustrated buyers that want to buy more units

than are being offered for sale. Once again, there's a clear solution: outbid the other buyers! So, if the price is $4 it will tend to rise. At a price of $5, buyers want to buy 4 units, and sellers want to sell 4 units. So, everyone who desires to buy at that price can. Everyone who desires to sell at that price can. So, there's no incentive to outbid the other buyers, and no incentive to undercut the other sellers. A price of $5 is "stable", and therefore is equilibrium.

3 A Few Quick Notes

In this piece, we've been looking at an economy in which the good already exists, and the only real question is how to allocate it. We've shown that supply and demand will allocate goods to those that are most willing to pay for them (or are least willing to give them up for money). However, we've not yet considered the case where the good can be produced for sale. That's a lesson for next time.

A second point I want to emphasize: the market gets goods to those who value them most - that is those who are able and willing to pay the most for them. If we believe that people place different values on goods (and that seems reasonable), then there's good reason to believe that markets provide a way for goods to "flow" to the people that value them most. In fact, it is possible to prove that the outcome of a competitive market in exchange is "Pareto efficient". That is, it makes everyone as well off as possible without making anyone worse off.