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Part I. Microeconomics

Let's begin with some basic definitions.

Supply : This refers to the quantity of a product that vendors are willing and able to sell at a given price in a given period of time.

Demand : This refers to the quantity of a product that consumers are willing and able to buy at a given price in a given period of time.

- 1) 'willing and able' : for example, some products are highly desirable, but unaffordable to many consumers.
- 2) 'time' : for example, the demand for overcoats is greater in winter than in summer.

Other determinants include :

- ~~on less~~^{on} ~~for~~ demand :

- the number and price of substitute goods.
e.g., tea vs coffee
bus vs tube

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-) the number and price of complementary goods
eg. cars and petrol
-) the level and distribution of income across society as a whole.
-) consumers' tastes and habits
-) consumers' expectations for the future

Other determinants of supply :

- changes in prices of inputs to production
eg., the cost of steel for making cars
-) changes in production technology
-) organisational changes

Law of demand : This states that an

increase in price will usually lead to a drop in demand (if all other factors remain unchanged).

This is linked to the following:

The income effect: A rise in price results in a decrease in the consumer's purchasing power; their income no longer covers the cost of the same quantity of the commodity in question.

The substitution effect: A rise in a good's price may result in consumers substituting it for a similar, less expensive good.

Law of supply: An increase in price usually leads to an increase in supply.

In a market economy, the price of a good is determined according to its supply and demand through the following mechanism:

⇒ If supply exceeds demand, prices drop as the sellers compete to sell the commodity. This

acts to encourage demand (as follows from the
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Law of demand).

o) If demand exceeds supply, prices rise as consumers compete with one another to buy the good. This incentivises increased supply, as per the Law of supply.

Through this mechanism, an equilibrium price may be reached at which supply and demand are equal.

In mathematical terms, let $p \in [0, \infty)$ denote the price of a unit of a commodity. We will generally consider p as a continuous variable.

Let $D(p)$ ^{demand function} denote the demand of the commodity. This is measured in units of the commodity. This may be discrete or continuous, but will be

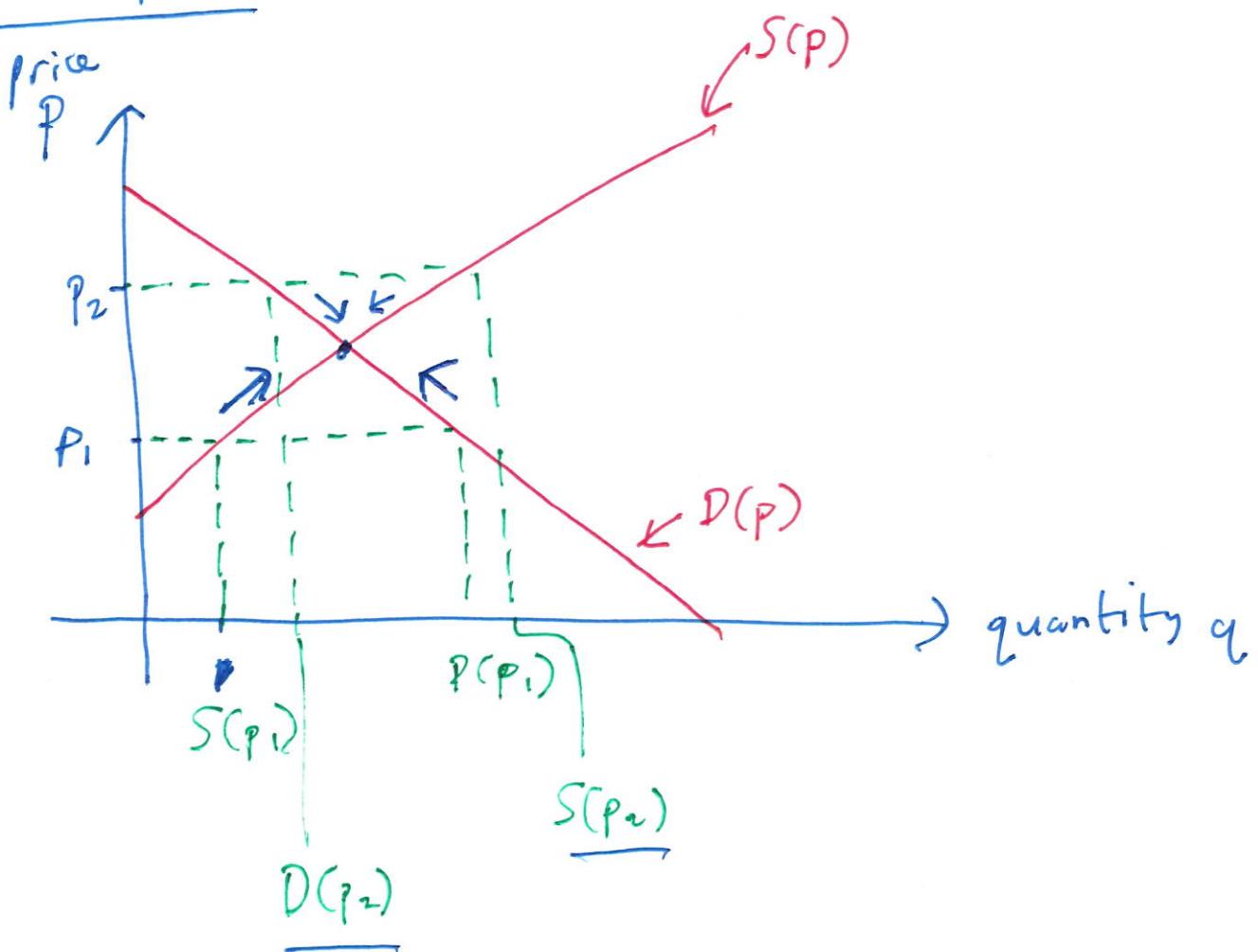
non-negative.

Let $S(p)$ ^{Supply function} denote the supply of the commodity.

Generally, as p increases, so $D(p)$ decreases (5)
 (as per the Law of demand) while $S(p)$
 increases (as per the Law of supply).

If $D(p)$ and $S(p)$ can be inverted, we refer
 to their inverses as the inverse demand and
inverse supply functions, respectively.

Example



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Another example of supply and demand curves is the topic of a question on PS1.

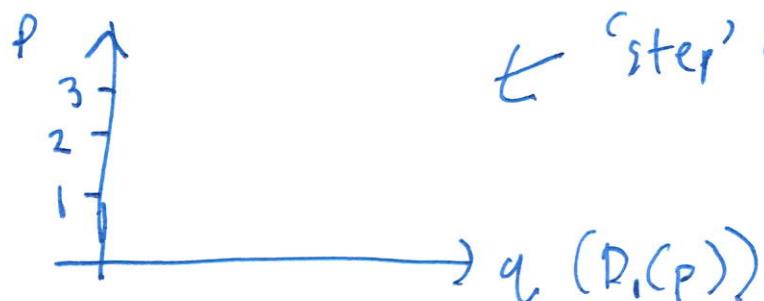
(Q1 :

Student 1

Quantity of cups offered per unit	1	2	3
Price " in £	3.00	2.00	1.00

reservation price (this is the maximum price per unit of the commodity that the consumer is prepared to pay).

In this case, Student 1 is prepared to buy 3 cups if the price per cup is no more than £1, 2 cups if the price per cup is ~~not~~ \geq £1 but \leq £2, and 1 cup if the price per cup is $>$ £2, but \leq £3.



'Calculate' ~~$D_1(p)$~~ : write down a formula
for it in terms of the step function defined as
follows :

$$\mathbb{I}_{[a,b)}(p) = \begin{cases} 1 & \text{for } p \in [a,b) \\ 0 & \text{otherwise} \end{cases}$$

'Aggregate' demand function:

$$D_1(p) + D_2(p) + D_3(p)$$

$p(2)$ *reservation price*

'Calculate' the inverse demand function for
~~student~~ student 1.

$$\underline{p_1(1) = 3}, \underline{p_1(2) = 2}, \underline{p_1(3) = 1},$$

$$\underline{p_1(n) = 0 \text{ for } n \geq 4}$$

Price elasticity of demand and supply

When examining the effect of price on demand and supply, it is helpful to consider what is known as the price elasticity of demand / supply.

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This is a measure of relative change in demand/supply in response to a relative change in price of a product.

More rigorously, we define the price elasticity of demand $\epsilon_D(p)$ as

$$\epsilon_D(p) = \lim_{\delta p \rightarrow 0} \frac{\delta D/p}{\delta p/p}$$

$$= \frac{\partial D}{\partial p} \cdot \frac{p}{D}$$

Similarly, one can define the price elasticity of supply:

$$\epsilon_S(p) = \frac{\partial S}{\partial p} \cdot \frac{p}{S}$$

As follows from the Law of demand, generally, $\epsilon_D(p) < 0$ while $\epsilon_S(p) > 0$.

If the demand for a product is fairly resilient to price changes, we say it is inelastic. If the demand for a product is very sensitive to price changes, we say it is elastic. In terms of ϵ_D :

-) a product is said to have inelastic demand if (9)
 $|E_D| < 1$
-) a product is said to have elastic demand if
 $|E_D| > 1$
-) if $|E_D| = 1$, then the product is said to have unit elastic demand.

Determinants of E_D include:

- o number and closeness of substitute goods.
- o proportion of income spent on the good.
- o time span

It is also helpful to consider what is known as the cross-price elasticity of demand (or supply).

This measures the relative change in demand (or supply) of a product A in response to a relative change in price of a product B.

More rigorously, this is defined as

$$\epsilon_B^{cp}(p) = \lim_{\delta p_B \rightarrow 0} \frac{\delta D_A / D_A}{\delta p_B / p_B}$$

$$= \frac{\partial D_A}{\partial p_B} \frac{p_B}{p_A}$$

The sign of this cross-price elasticity of demand indicates the relationship between goods A and B. If A and B are complementary goods (eg. cars and petrol), $\epsilon_B^{cp} < 0$. If A and B are substitute goods (eg tea and coffee), $\epsilon_B^{cp} > 0$.

If $\epsilon_B^{cp} = 0$, then A and B are said to be independent goods.