Factors of Production

The scarce productive resources of an economy can be placed into one of the four following headings.

1) LAND
2) LABOUR
3) CAPITAL
4) ENTERPRISE

The Factors of Production: are those resources that are used in the production of goods and services

In general terms, Factors of Production are the "stuff" used to make "things".

E.g. these wonderful notes that you are reading required some combination of all four factors of production to be made.

1) **Land:** They were typed up in my apartment.
2) **Labour:** The countless hours that I spent typing them were, of course, a pleasure but also an example of labour.
3) **Capital:** The laptop that I am using right now to type them and subsequently the internet domain on which they will be stored.
4) **Enterprise:** The ingenious idea that I had in the first place to create these notes and sell them in the marketplace (for grinds).

Enterprise is said to be the factor of production that combines the other factors of production in order to produce goods and services. It is for this reason that most economists believe enterprise to be the most important factor of production.

There are markets for these factors of production where they can be bought (demanded) and sold (supplied).

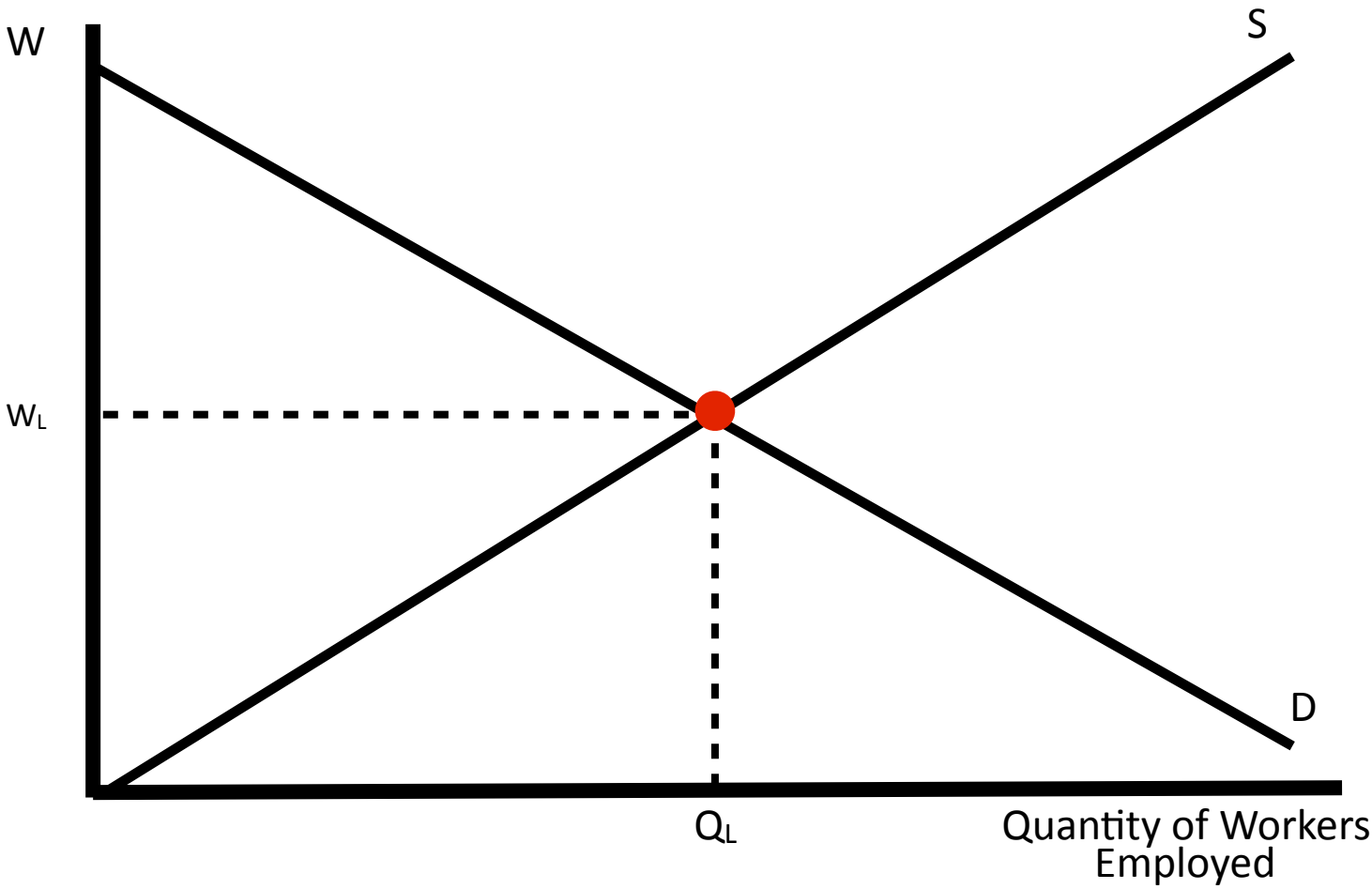
Such markets are called Factor Markets.

Factor Markets: are markets where the factors of production are demanded and supplied.

E.g. The Labour Market

Like all free markets, the price for each of the factors of production depends on the demand and supply for that factor. In equilibrium, the quantity demanded of a factor of production equals the quantity supplied of that factor of production. Also the price received by that factor of production (which of course is equal to the price paid to that factor of production) is the payment that the factor receives for his contribution to the production process. See Diagram Below.

The Demand and Supply for Labour (or any Factor of Production)



In the diagram above we have the Demand for Labour (downward sloping from left to right, showing that as wages falls employers are inclined to hire more workers as labour has become relatively cheaper) and the Supply of Labour (upward sloping from left to right showing that workers are more willing to work at higher wage rates.)

Q_L is the quantity of man hours that employees are paid by their employer to work and W_L is the wage that the workers receives per hour.

Even though we have used the example of the labour market in this diagram, the same mechanism (the intersection of demand and supply) brings each factor market into equilibrium.

Back to Factor Markets

We have just seen that it is the intersection of the demand for a factor of production and the supply of a factor of production that bring each factor market into equilibrium. The factor's equilibrium price represents the amount of money the owner of each factor of production gets per hour it is used (the owners of Labour are paid a wage, the owners of Capital are paid interest etc) in the production process. The factor's equilibrium quantity tells us how many hours this factor will be used in the production process.

The markets for factors of production do however; have one defining quality that makes them different from other markets.

The demand for a factor of production is said to be a derived demand.

Derived Demand: refers to the fact that a factor of production is demanded for its contribution to the production process.

This idea might best be explained by way of an example.

E.g. A builder does not demand bricks because he considers them to be beautiful, that is, not for their own sake. He buys them because he can use these bricks to make houses and sell these houses to make a profit.

This is the idea of derived demand, the demand for a factor of production because it can be used to make something else for which there is a demand. That is the demand for a factor of production is derived from the demand for the goods and services that they produce. A rise in the demand for houses causes a rise in the demand for those factors of production that produce houses (Builders, timber, concrete etc).

The price, which will be paid in order to acquire a factor (in the case of labour the wage that a worker receives per hour), depends on the extra revenue that the firm will earn through employing that factor. If the firm can sell what the worker produces for a lot of money then the worker will be paid a lot of money. If the price of houses go up, builders will be paid more money per hour.

So far we should realise that it is the intersection of the demand for Labour and the supply of Labour that tells us how much workers earn and how many hours will be worked in an **economy** (Macroeconomics). The question that we now must answer is "how many workers will an **individual firm** choose to hire?" (Microeconomics).

To answer that question we need to look at a few different terms. We are assuming a Perfectly Competitive Firm and a Perfectly Competitive Labour Market. In short we are assuming that the firm can continue to hire new workers without having to increase the wage rate.

Marginal Productivity Theory

In order to answer the question of "how many units of each factor of production an individual firm will hire?, we must understand the idea of Marginal Productivity Theory. There are three essential concepts that we will now discuss.

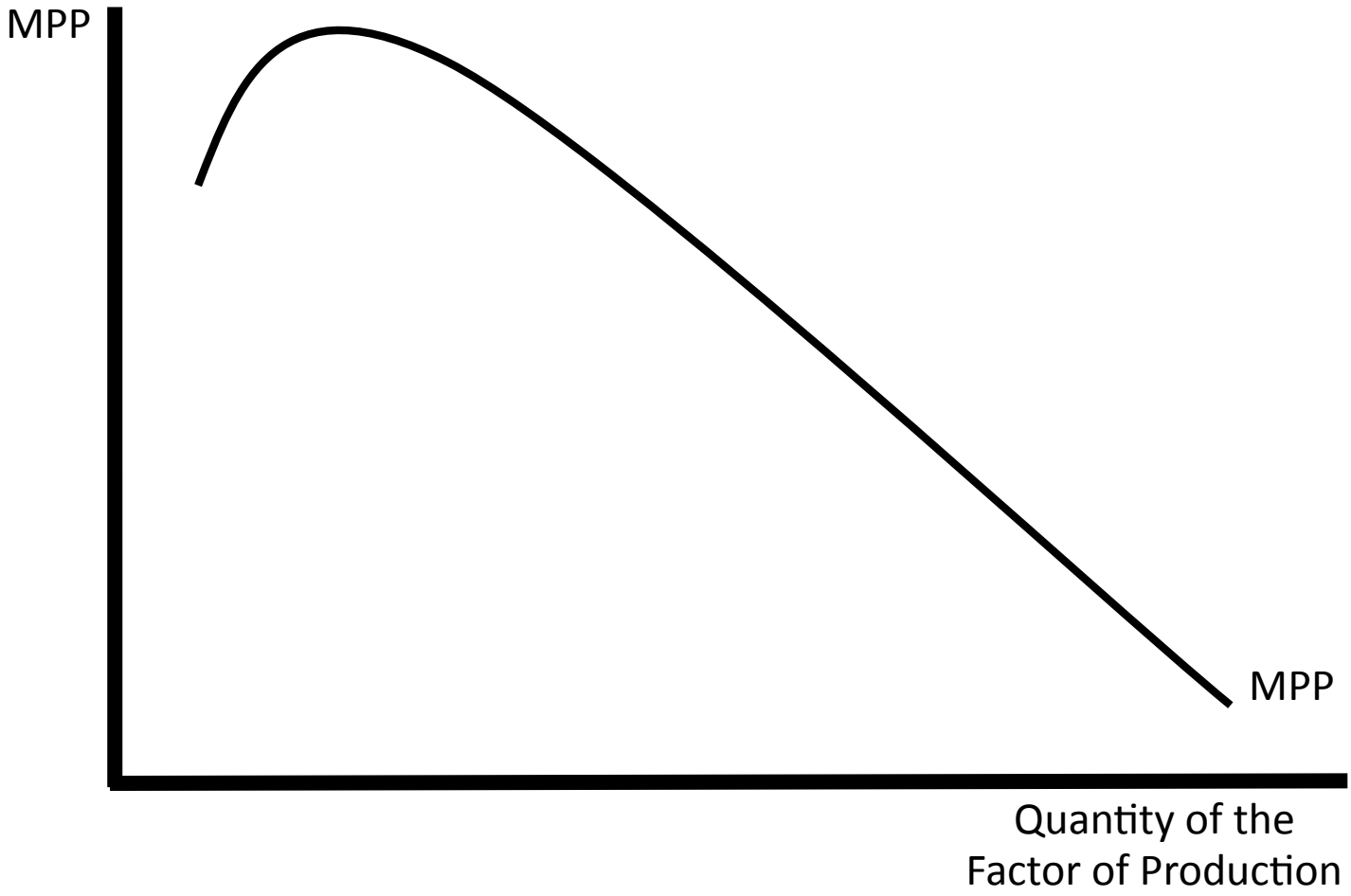
1) Marginal Physical Product (MPP)
2) Marginal Revenue Product (MRP)
3) Marginal Revenue (MR)

The first concept that we must deal with is Marginal Physical Product.

Marginal Physical Product (MPP): is the extra output produced when an additional unit of a factor of production is employed.

I.e. it is the amount of extra physical stuff that is made from employing one extra unit of a factor of production. This could be an extra worker, another machine, another acre of land etc.

Marginal Physical Product (MPP) Curve



The shape of the Marginal Physical Product (MPP) curve slopes upward initially as extra factors of production are hired and then slopes downward after that, as extra factors of production are hired.

This means that a firm with only a few workers, as this firm hires more workers, the amount of extra "stuff" that each worker produces increases as more workers are hired. This happens up to a point. After this point, as the firm hires more workers, the extra "stuff" that each worker produces begins to fall again. Look at the table below

Number of Workers	Total Output (Computers)	Marginal Physical Product (MPP)
1	6	6
2	16	10
3	31	15
4	56	25
5	86	30
6	106	20
7	124	18
8	140	16
9	154	14
10	166	12

Looking at the table above initially, as more workers are hired, the extra output that each worker is responsible for (MPP) increases. We can see this by looking at the MPP from worker 1 up to and including worker 5. The MPP for each of these workers is bigger than the previous worker. Then from worker 6 and beyond, the extra output that each individual worker is responsible for (MPP) is falling.

The reasons that the MPP curve slopes upward and then downward are the exact same reasons as the shape of the MC curve. A rise in productivity always accompanies a fall in costs and a fall in productivity accompanies a rise in costs. They are opposite sides of the same coin.

The Shape of the Marginal Physical Product Curve

1) Initially, the MPP curves slopes upward due to the greater returns from the increased degree of specialisation of each factor of production.
2) The MPP curves starts to slope downwards again due to the Law of Diminishing Marginal Returns which states that as extra units of a variable factor of production are added to a set sized fixed factor of production, eventually a point will be reached when the extra output caused by the last unit of the variable factor of production employed begins to decline.

Now on to our next definition.

Marginal Revenue Product (MRP): is the extra revenue earned when an additional unit of a factor of production is employed.

I.e. it is the extra money that a firm earns from employing an extra unit of a factor of production. I.e. The extra revenue a firm receives from employing one more worker.

To mathematically calculate the Marginal Revenue Product, it might seem obvious to just multiply the MPP X Price. This works great for Perfect Competition as a firm can sell all it produces at the market price and does not have to lower price in order to sell more goods. See Below.

EXAMPLE: Calculate the MRP for each worker that is employed in a Perfectly Competitive Firm.

Number of Workers	Total Output	Marginal Physical Product (MPP)	Price	Marginal Revenue Product (MRP)
0	0	-	10	-
1	10	10	10	?
2	22	12	10	?
3	32	10	10	?
4	40	8	10	?
5	45	5	10	?

ANSWER:

Number of Workers	Total Output	Marginal Physical Product (MPP)	Price	Marginal Revenue Product (MRP)
0	0	-	10	-
1	10	10	10	100
2	22	12	10	120
3	32	10	10	100
4	40	8	10	80
5	45	5	10	50

This is the correct method to calculate MRP for a factor of production working in a Perfectly Competitive Firm. Again, the reason is that if the firm wishes to sell more, they do not need to lower price. As a result of its Perfectly Elastic Demand Curve, a Perfectly Competitive Firm can sell infinite quantity at the Market Price.

However, the formula; MRP = MPP X PRICE; does not work for any other industry. The reason being is that, a firm in Imperfect Competition, Oligopoly or Monopoly, has to lower price to sell more goods.

When a firm hires more workers, each worker causes an increase in Total Output. In order to sell this extra output (MPP), the firm must lower price (the law of demand). As such, in order to calculate MRP for Imperfect Competition, Oligopoly or Monopoly; we need a formula that takes into account the fact that in the other markets structures, the law of demand applies and as such the firm must lower its price in order to sell the extra output that these extra factors of production have produced. This causes the MRP for workers in these Market Structures to fall quicker than for workers employed in Perfectly Competitive firms.

Before we look at the formula that we will use, we just need to look over one more definition.

Marginal Revenue (MR): is the extra revenue received by the firm for producing one extra unit of output.

The relationship between

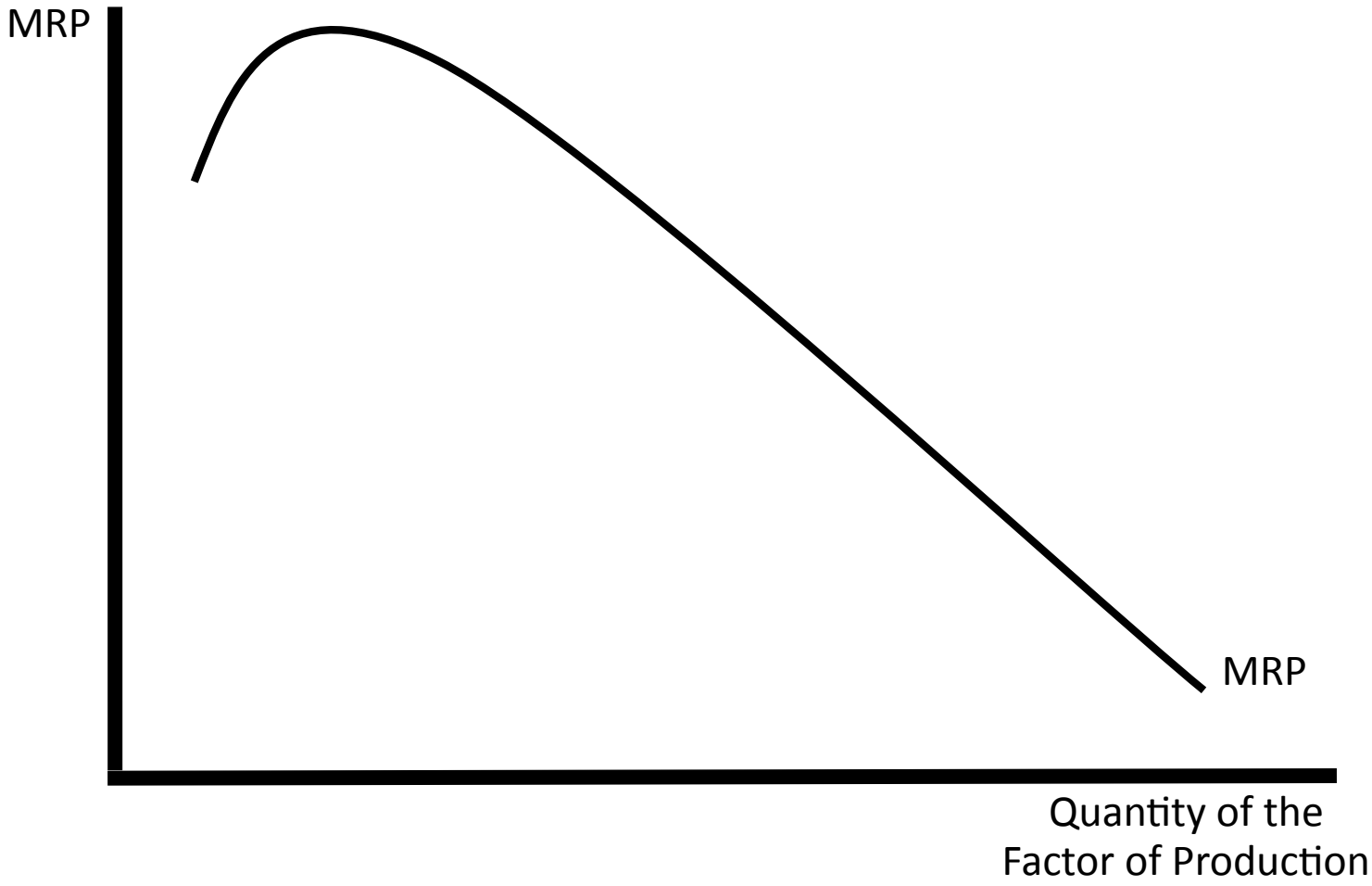
1) Marginal Physical Product (MPP)
2) Marginal Revenue Product (MRP)
3) Marginal Revenue (MR)

Is given by the equation

Marginal Revenue Product = Marginal Physical Product X Marginal Revenue

MRP = MPP X MR

<u>Marginal Revenue Product (MRP) Curve</u>



Marginal Revenue Product is calculated by multiplying Marginal Physical Product by Marginal Revenue.

This is because MPP is the extra amount of output that the firm gains from employing one extra unit of a factor of production and MR is the money a firm receives from selling one extra unit of output.

Therefore if you multiply the amount of extra product (MPP) by the amount of extra revenue the firm gets for the sale of each product (MR), your answer is the extra amount of revenue received by the firm (MRP).

Explaining the Shape of the Marginal Revenue Product Curve

We have already stated that the method for calculating MRP in Perfect Competition is different to the way we calculate MRP in either Imperfect Competition, Oligopoly or Monopoly. What I will do now is try to convince you that they are in fact the same formula.

We said to calculate MRP in Imperfect Competition, Oligopoly or Monopoly you use the following formula

MRP = MPP X MR

We also said to calculate MRP in Perfect Competition you use a different formula

MRP = MPP X PRICE

The only thing you should note here is that, in Perfect Competition, Price = Marginal Revenue (P = MR). Therefore, we were actually always using the first formula to calculate MRP in Perfect Competition. The only difference was that we were calling Marginal Revenue, Price.

One thing to keep in mind here is that, in Perfect Competition, Price (or Marginal Revenue) is constant. It does not change. If the individual Perfectly Competitive firm wishes to sell extra output, they do not have to lower price. This is due to their Perfectly Elastic (flat) demand curve. You can look at it as not obeying the Law of Demand.

However, if a firm wishes to sell a greater quantity and is not operating in a Perfectly Competitive market (the firm is operating in one of the other three market structures), then they have to lower price to sell the extra output that was produced by the extra unit of a factor of production. This is because, firms in these market structures face downward sloping demand curves, and as such have to lower price to sell more goods.

Therefore, to explain the shape of the MRP curve depends on which market structure the firm is operating in.

Explain the Shape of the MRP curve for a Perfectly Competitive Firm

1) Initially, the MRP curves slopes upward due to the greater returns from the increased degree of specialisation each factor of production.
2) The MRP curves starts to slope downwards again due to the Law of Diminishing Marginal Returns which states that as extra units of a variable factor of production are added to a set sized fixed factor of production, eventually a point will be reached when the extra output caused by the last unit of the variable factor employed begins to decline.

Explain the Shape of the MRP curve for a Firm in either Imperfect Competition, Oligopoly or Monopoly

1) Initially, the MRP curves slopes upward due to the greater returns from the increased degree of specialisation of each factor of production.

The MRP curve starts to slope downwards for two reasons

2) Law of Diminishing Marginal Returns which states that as extra units of a variable factor of production are added to a set sized fixed factor of production, eventually a point will be reached when the extra output caused by the last unit of the variable factor of production employed begins to decline.
3) Law of Demand: If sellers (firms) in these markets wish to increase the quantity of the goods that they sell, they must lower price. This causes MRP to fall faster than it otherwise would in Perfect Competition.

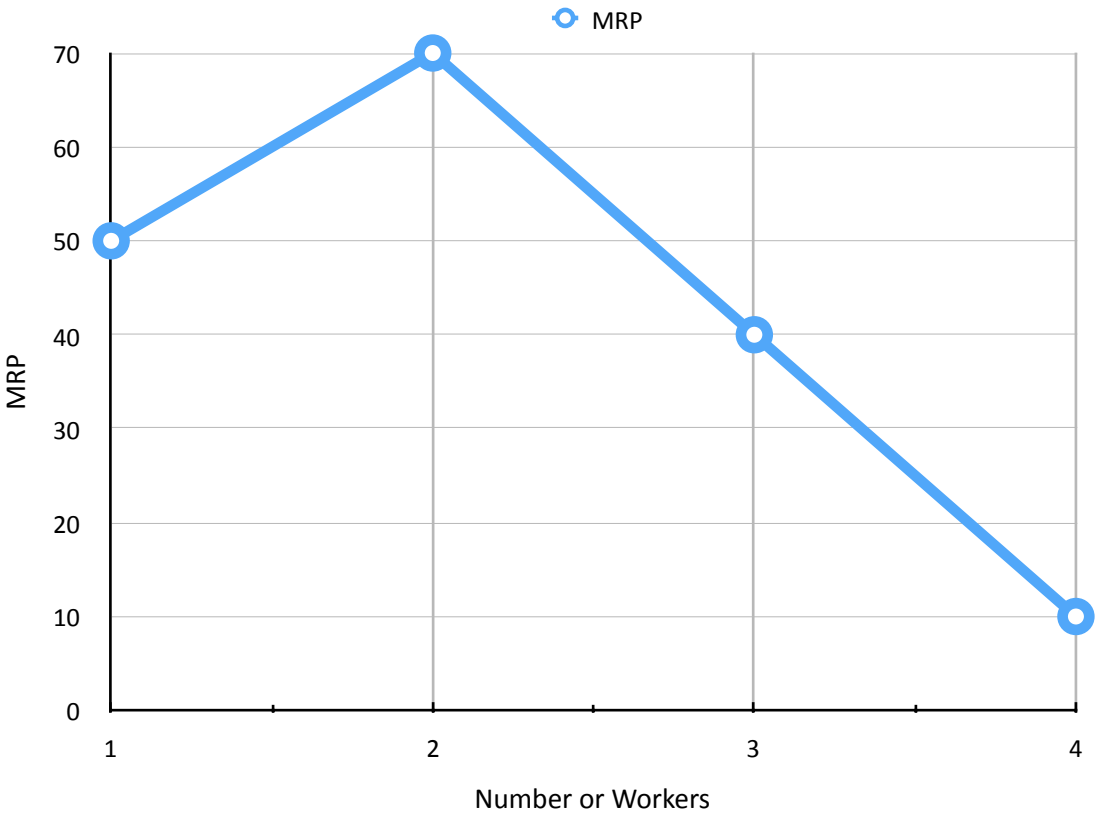
EXAMPLE:

From the data listed below, complete the table and then draw the Marginal Revenue Product Curve. What type of Market Structure is this firm operating in? Give a reason for your answer.

Number of Workers	Total Output	Marginal Physical Product (MPP)	Price	Marginal Revenue Product (MRP)
0	0		10	
1	5		10	
2	12		10	
3	16		10	
4	17		10	

Answer:

Number of Workers	Total Output	Marginal Physical Product (MPP)	Price	Marginal Revenue Product (MRP)
0	0	-	10	-
1	5	5	10	50
2	12	7	10	70
3	16	4	10	40
4	17	1	10	10



The firm is operating in a Perfectly Competitive Market as the firm does not need to lower price in order to sell more output. The Price that the firm charges it customers does not change as sales expand.

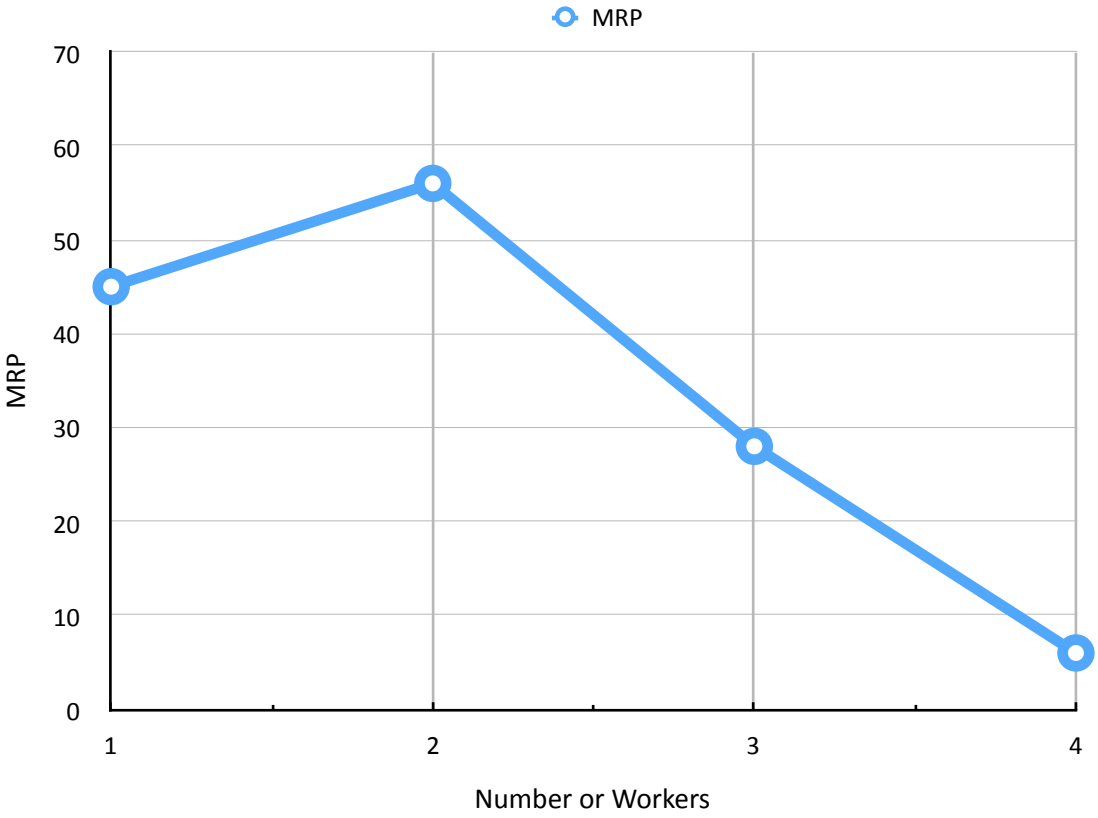
EXAMPLE:

From the data listed below, complete the table and then draw the Marginal Revenue Product Curve. What type of Market Structure is this firm operating in? Give a reason for your answer.

Number of Workers	Total Output	Marginal Physical Product (MPP)	MR	Marginal Revenue Product (MRP)
0	0		10	
1	5		9	
2	12		8	
3	16		7	
4	17		6	

Answer:

Number of Workers	Total Output	Marginal Physical Product (MPP)	MR	Marginal Revenue Product (MRP)
0	0	-	10	-
1	5	5	9	45
2	12	7	8	56
3	16	4	7	28
4	17	1	6	6



I would most likely expect this firm to be either Imperfectly Competitive, Oligopolistic or monopolistic. This is because the firm must lower price in order to sell more output. The price that the firm charges its customers fall as sales expand. (It is less likely to be Oligopolistic than the other two as firms in Oligopoly tend not to change their prices based on fear of the potential reaction from their competitors).

How does a firm Decide the Quantity of Factors of Production to Employ?

Now that we know how to calculate MRP we must ask the question "how does the firm decide on what quantity of each factor of production to employ?"

The answer lies in the relationship between Marginal Revenue Product (MRP) and Marginal Costs (MC).

The Marginal Benefit to the firm of hiring one extra unit of a factor of production is that factors MRP. This is the amount of extra money that factor brings into the firm. E.g. if the MRP of one extra worker is €1000 per week, then this is the Marginal Benefit to the firm of hiring that extra worker. Therefore, we must make the important leap and say that the ***MRP curve is the demand curve for a factor of production***, the higher the extra revenue gained from employing a factor of production, the greater the demand for that factor.

The Marginal Cost to the firm would be this workers wages.

If the wage of a worker is €900 per week, the firm will employ this worker as his MRP > MC. (€1,000 > €900)

If the wage of a worker is €1,100 per week, the firm will not employ this worker as his MRP < MC. (€1,000 < €1,100)

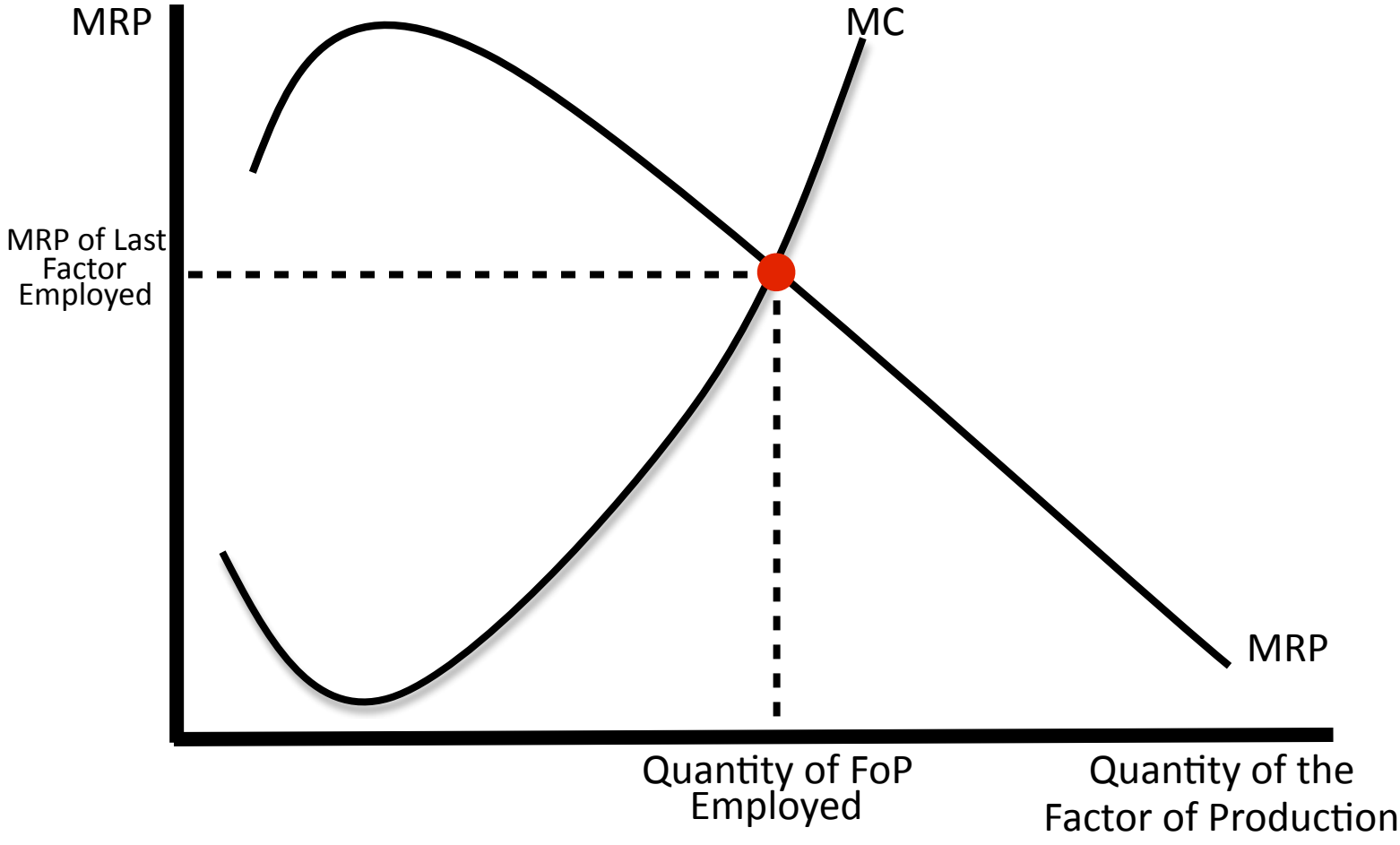
If the wage of a worker is €1,000 per week, the firm will employ this worker and no more. (€1,000 = €1,000)

It is the point where MRP = MC, that the firm stops employing workers because at this point all potential benefits from employing extra workers has been exhausted and to continue to employ more workers beyond this point would result in the firm paying out more money to that worker than it would receive from selling that workers output in the marketplace.

It is this logic that the firm uses in order to decide what amount of each factor of production to employ.

The firm will continue to employ extra units of each factor of production up to and including the point where **MRP = MC.**

Marginal Revenue Product (MRP) and Marginal Cost



More technically, its the downward sloping part of the MRP curve is the demand curve for that factor of production.

Factors that Affect the MPP of a Factor of Production

Marginal Physical Product (MPP): is the extra output produced when an additional unit of a factor of production is employed.

1) **Quality or Specialised Nature of the Factors:** If the quality of the factor used improves then that factor may become more efficient and so additional output will be produced, resulting in increased MPP.
2) **Training or Education Provided for the Factor:** If the factor is more highly trained or has attained a good standard of education then it may become more skilled, resulting in increased efficiency and more output.
3) **Expertise of the Entrepreneur:** If the entrepreneur has expertise in organising the production unit, then each factor may be more productive and work to its maximum efficiency.
4) **Law of Diminishing Marginal Returns:** As each additional unit of a factor is used a point will be reached where the additional output produced will decline and so MPP will decline.

As the Marginal Revenue Product (MRP) is proportional to the Marginal Physical Product (MPP), everything that effects the MPP also effects the MRP.

Factors that Affect the MRP of a Factor of Production

Marginal Revenue Product (MRP): is the extra revenue earned when an additional unit of a factor of production is employed.

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4) **Law of Diminishing Marginal Returns:** As each additional unit of a factor is used a point will be reached where the additional output produced will decline and so MRP will decline.
5) **The Productivity or Commitment of the Factor:** The more productive each additional factor employed is then the more MRP that factor will earn. The more conscientious a person is then the more productive that person will be.
6) **The Selling Price of the Output:** If the selling price obtained on the market is rising or constant (and not falling) then the higher will be that factor's MRP.
7) **The Law of Demand:** On the market, the law of demand dictates that in order for more to be bought then price must be reduced – this affects the MRP obtained by the firm.

Difficulties in Measuring MRP

1) **Not all Factors Produce Physical Output:** Where services are provided no physical output is produced and so MRP cannot be measured.
2) **Output Not Sold in the Market Place:** In the public sector where output is not sold in the market it is difficult to calculate MRP.
3) **Combination of Capital and Labour to Produce Additional Output:** It is difficult to measure the contribution of each individual factor.

Supply Price, Economic Rent and Transfer Earnings

Supply Price: The minimum payment necessary to bring a factor into use and maintain it in that particular use.

It is the amount of money that the owner of that factor of production must receive in order to keep that factor doing what it is doing in the long run. E.g. A stockbroker may not be willing to work for less than 1,000 a week. This is his supply price. If his wages fall below 1,000 a week he quits.

Economic Rent: Any earnings of a factor of production above its supply price/transfer earnings.

E.g. An avid rugby fan may be willing to work for the I.R.F.U. for €20,000 a year. However if this person gets a job in the I.R.F.U. for €50,000 a year than his economic rent is €50,000 - €20,000 = €30,000.

Transfer Earnings: The earnings of a factor in the next best alternative employment.

or

What a factor must receive to keep it in its present use and prevent it from transferring to another use.

E.g. If a stockbroker is earning €1,000 a week as a stockbroker but could earn €900 a week as an investment banker, then the €900 is his transfer earnings and the €100 is economic rent.

Also, if a factor of production is specific, then it has no other uses. Its transfer earnings would be zero and so the entire payment is economic rent.

Economic Rent = Payment to that Factor - Transfer Earnings

This might seem unusual, because when explaining economic rent, we said that it was current wage minus supply price. Well it actually is, but the idea here is that your transfer earnings become your supply price and as such we have the previous formula. This logic should be somewhat intuitive. If you can get more money in another job (Transfers Earnings) you will move to that other job. See the example below.

L.C.Q.

A computer software engineer, who earns €40,000 annually in her current employment, decides to become an entrepreneur and set up her own business in which she expects to earn €75,000 annually.

(i) What is this entrepreneur's supply price? Explain your answer.

(ii) If the business performs as expected, will the entrepreneur earn an 'economic rent'? Explain your answer. (15 marks)

Answer

(i) The entrepreneur's supply price is €40,000 as this is the minimum payment she needs to receive to work as a software engineer.

(ii) Yes, if the business performs as expected the entrepreneur will earn an economic rent. She will earn €35,000. As her supply price is €40,000 and she will earn €75,000 annually as an entrepreneur, the economic rent earned is what she earns in excess of her supply price.

Circumstances under which a Factor of Production could earn an Economic Rent

1) **Shortage in the supply of any factor of production:** if land / labour is in short supply – its price will increase.
2) **Possession of a rare skill or talent:** if a person has a skill which is in great demand e.g. a professional soccer player then they can command high fees.
3) **Rent of Ability:** an entrepreneur who invents a much sought after commodity may command high income e.g Bill Gates and the invention of the 'windows' operating systems
4) **Completely Specific Factors of Production:** there is no opportunity cost in the use an existing factor of production which is completely specific (not adaptable to other uses e.g. a railway station). If a payment is made for the use of this specific factor then this entire payment would be economic rent as the opportunity cost is zero.

Rent of Ability: is an economic rent earned by a factor of production due to their natural talent or business acumen.

E.g. Premier League Footballer who has a superior physical ability.

Referring back to economic rent, a factor of production can earn economic rent when it is not possible to increase the supply of that factor.

The Control of Economic Rent

Economic Rent can be seen as a surplus payment to a factor of production which is not necessary to keep it in its present use and as such it is often suggested that such economic rent should be taxed or controlled in some way. The following are suggested methods that could be used in controlling economic rent.

1) **Imposition of a Maximum Price:** A maximum price could be imposed on a factor. This usually attempted by the government and occasionally by private organisations. However it is rarely successful. Attempts were made to put an upper limit of transfer fees on soccer players in England which were unsuccessful. Highly skilled individuals with rare talents are generally able to continue to earn economic rent as long as their talents are in demand.
2) **Tax Economic Rent:** The main advantage in taxing economic rent is that the government gains revenue and the tax does not affect resource allocation. However it is exceptionally difficult to accurately calculate economic rent especially for factors other than land. If the

government were to pursue this policy, it may cause the factors of production to leave the economy resulting in reduced GNP.

3) **Government Action:** The government can take measures to increase the supply of a factor of production so that economic rents can be reduced or eliminated. E.g. tradesmen. Up until recently carpenters were earning massive economic rent in the boom years. The government could have encouraged skilled immigration or increased the number of apprenticeships available. Unfortunately a drop in demand following the economic downturn was responsible for eliminating their economic rent.

Types of Factors of Production

1) **A Specific Factor:** A specific factor of production is specialised and therefore cannot be easily adapted to other uses. A rocky piece of hillside land is perhaps only useful for grazing sheep and goats and as such could be classified as a specific factor of production.

2) **A Non Specific Factor:** A non specific factor of production can be easily transferred from one use to another. A flat well irrigated field can be used to grow crops, build houses, mine for precious metals etc.

3) **Occupational Mobility:** refers to the mobility or movement of a factor of production from one type of productive activity to another type of productive activity. If an economics teacher lost his job, with his qualifications in economics, he could hope to find employment in Investment Banking.

4) **Geographical Mobility:** refers to the mobility or movement of a factor of production from a productive activity in one location to a productive activity in another location. Geographical mobility is the ease with which resources can change locations. Now with the EU, European workers can live and work in any European country (that is a member of the EU) without any visa or other red tape. This has increased the degree of geographical mobility for European labour.

In economics we have different names for the return/reward/payment that each of the factors of production receive and it is necessary to know each of them as they can come up in both the long and short questions.

FACTOR OF PRODUCTION	REWARD
LAND	RENT
LABOUR	WAGES
CAPITAL	INTEREST
ENTERPRISE	PROFIT