

## **Economic Environment and Business Strategy**

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**Lecture- 04**

### **Understanding the Elasticity Concepts**

Hello, everyone. Welcome to this session. The focus of today's discussion is to explore the concepts of elasticity of demand and supply. We will also examine why studying these topics is essential and how they relate to the business environment and strategy. This can be understood by considering a few questions. For example, why do airlines charge different prices for the same seat depending on when it is booked? Why does the government hesitate to tax essentials like salt, rice, and wheat but not luxury cars? The reality is that businesses operate in a competitive environment where they must make careful pricing decisions. When they set prices too high, they may think they can earn more revenue, but there's a risk of losing customers. Conversely, if they set prices too low, they miss out on potential profit. So how do they determine the right price? In this context, the elasticity of demand helps firms predict how consumers will respond to price changes.

Consumer sensitivity to price, also known as elasticity, plays a crucial role in pricing, taxation, and business strategy. Elasticity, a concept we will examine shortly, influences a firm's revenue strategy. Should a firm lower the prices to sell more or raise prices to increase earnings? In marketing, should price reductions be used to promote new products? Regarding taxation, when the government considers a tax increase, will it reduce consumption or increase revenue? In this context, elasticity helps us measure how responsive people are to changes in price, income, or other factors. So far, from the previous session, we know that demand and supply analysis are fundamental to understanding the market.

We have defined the law of demand and then presented it through a demand schedule, a supply schedule, a demand curve, and a supply curve. This framework allows us to predict how prices and quantities will change in response to specific events. For example, we observed a situation where a freeze in a Latin American country led to a decline in coffee production. From this, we observe that when supply decreases, it affects the price, which in turn impacts demand. In all these cases, we can predict the direction of the change but not its exact magnitude.

In that way, demand and supply analysis is primarily qualitative. It involves a graphical approach that shows the direction of change in quantity demanded and price. For more

precise estimates, we need to use elasticity, which measures the magnitude of changes in the quantity demanded in response to changes in price. In this context, it is mainly quantitative because it helps us quantify how much quantities change in response to events. Understanding how to measure consumer responsiveness (elasticity) and producer responsiveness is crucial for firms and policymakers who want to know the extent of these changes. For example, the demand curve I drew here features both a steep and a flat section to illustrate different elasticities. When the demand curve is steep, it indicates inelastic demand, and when it's flat, it means more elastic demand.

There is a very steep curve when there is a change in supply; for example, if the supply curve shifts to the right, initially the price declines from one point to another, and then the quantity demanded increases. Here, the initial price decreases to  $P_1$ , and you can see that the quantity demanded changes; it increases from  $Q_2$  to  $Q_1$ . This can also be interpreted in the opposite sense, as the curve shifting upward indicates that a significant change in price results in a relatively minor change in the quantity demanded. The critical point here is that when the demand curve is steeper—that is, when demand elasticity is low—a slight change in price results in a significant change in the quantity demanded. Conversely, when there's a slight increase in price, from  $P_1$  to  $P_2$ , the quantity demanded decreases more significantly, going from  $Q_1$  to  $Q_2$ .

Therefore, you can see that a significant change in quantity demanded results from a relatively small price change. This indicates that, in this case, consumer demand is more responsive, more elastic. Conversely, in the previous case, the first example, responsiveness is very low; the quantity demanded changes minimally with each unit change in price. I have explained this and provided some texts for you to follow. You can review them, and my main goal here is to demonstrate the responsiveness of quantity demanded. Similarly, the supplier can also draw a demand curve that is more steeply sloped or flatter.

If it is steeper, that indicates there will be little response from the quantity supplier. The supplier reacts very little to changes in price. Therefore, in the case of a highly elastic supply and a producer, suppliers respond much more aggressively, even to minor price changes. Let's discuss this in detail. With this in mind, we will explore why elasticity is a preferable measure of responsiveness compared to slope, how to measure it, and how to calculate it.

Regarding elasticity, the proper definition of demand elasticity is that it measures how much the quantity demanded responds to changes in an underlying factor, whether the change is an increase or a decrease in the factor. Different types of elasticity exist. We observe that changes influence the price of an item in the prices of related products, as well as the resulting shift in the quantity demanded. Similarly, when a buyer's income

changes, whether it increases or decreases, an increase in income generally leads to a rise in the amount demanded.

But how much? If there's a one-unit increase in income, how much does the quantity demanded change? Similarly, when the prices of complementary or substitute products fluctuate, how much will be advertising expenditure change in response? For a one-unit increase in advertising expenditure, what is the likelihood of a change? What proportionate demand shift occurs? This is the formula used to measure the elasticity concept; it is this one. This means that elasticity is a concept used to quantify how one variable responds to a change in another variable. For example, the percentage change in variable A is due to the percentage change in variable B. In our case, we will use this: we will say "quantity demanded," and for the other variable, "price of this product."

This is a simple illustrative calculation. I think these are all very self-explanatory. As I mentioned earlier, what is the percentage change? Then, accordingly, you can calculate the percentage change for both the numerator and the denominator, and we can obtain the elasticity estimate. As I mentioned at the beginning, this means there will be changes in our prices, income, and the prices of related goods, whether they are substitutes or complements. With these changes in any of these, we can determine the likelihood or estimated changes in the quantity demanded.

So, in that way, there are different types of elasticity. The widely used one is called own-price elasticity. That means the percentage change in the quantity demanded of product X is due to the percentage change in the price of the commodity. That means, for example, changes in coffee demand due to changes in the price of coffee. That means when we refer to the elasticity of demand, we are referring to the price elasticity of demand.

These are examples. You can take any number of products. You need to take is their price itself that means when we are talking about the quantity demanded of x then the cost of x must be taken into account to calculate on price elasticity then the second one is called income elasticity of demand in this case income elasticity of demand we are saying that what the percentage change in quantity demanded of x for a given change percentage change in income of the buyer. We then have a third category, known as the cross-price elasticity of demand. Here, we calculate the percentage change in the quantity demanded of product X for a given change in the price of Y.

Simply put, you can state what the change in price of the quantity demanded of product X is. When there is a change in price, such as the price of coffee, but the change in quantity demanded remains constant, it is calculated using the cross-price elasticity of demand. Now, let us proceed to estimating the price elasticity of demand. As I mentioned earlier,

this means that the responsiveness of the quantity demanded of a good or service to changes in its price is referred to as its responsiveness.

Therefore, it is referred to as the price elasticity of demand. It can be measured along the demand curve itself. This is the formula I mentioned: always remember that calculating the percentage change in quantity demanded is divided by the percentage change in the price of the product. This is the formula to calculate it. You know that this represents  $Q_2$  minus  $Q_1$ .

This is nothing but  $\Delta Q$  divided by  $\Delta P$ , so  $\Delta Q$  divided by  $\Delta P$ . Here, calculates the percentage change in price in the same manner. You can calculate the percent change in price by dividing the change in price ( $P_2$  minus  $P_1$ ) by the initial cost ( $P_1$ ), which is equivalent to  $(P_2 - P_1)$  divided by  $P_1$  multiplied by 100. So, this is how we calculate it.

Simply put, this is the formula:  $dQ/Q/dP/P$ . If you rewrite it, it is much easier to remember; you can calculate it in this way:  $\Delta Q$  divided by  $\Delta P$  times  $P$  by  $Q$ . So, we also usually write it like this:  $dQ$  by  $dP$  times  $P$  by  $Q$ . So, this is the elasticity formula. Usually, this is referred to as the point elasticity of demand.

I will elaborate on this point. What are the pros and cons of using this method? I'm providing you with a simple table to calculate the elasticity of demand. Suppose the prices increase from 10 to 11; then you can see that the quantity demanded decreases. When we examine this table, we know that it illustrates the law of demand. The law of demand implies an inverse relationship. Suppose you read the table from top to bottom, the price declines from 10 to 11, then the quantity demanded declines from 100 to 95.

So, the one we are discussing now is that, by just looking at this table, it appears to be a qualitative change. Therefore, we aim to determine the proportionate change in quantity demanded resulting from a one-unit decline in price, given a one-unit change in price. So, to do that, you can apply this formula. First, calculate the percentage change in quantity demanded using the formula provided in the previous slide, and then calculate the percentage change in price. As you can see here, the elasticity of demand is -0.5.

So, what does it mean? The idea here is that a one-unit change in  $P$  results in a 50 percent decline in the quantity demanded. So, that's what you can see here: even looking at this price, you can see that the 10 became 11, which means a one-unit decline. However, here, 100 didn't become 90; it became only 95. This gives you a sense that when there is a 100% increase in one unit, you can see that the decline was 0.5, which means a 100% increase in price led to a 50% decline in the quantity demanded. Let me provide one more illustrative example.

A coffee seller's problems. If the price of a coffee were to decrease, how would this affect the quantity demanded? Suppose a coffee shop owner, a vendor, wants to increase the price from 1.65 to 1.70. So, from this, theoretically, you know the data: the coffee shop owner is experiencing a drop in the quantity demanded, from 140 units per day to 136 units per day. From this, we need to calculate the elasticity, which allows us to see the responsiveness of the quantity of coffee demanded with respect to a price increase.

Applying the formula, you will get -0.30. What does it mean? This means that a 1% price increase corresponds to a 0.3% decrease in the quantity of coffee demanded. That means, equivalently, a 1% drop in price corresponds to a 0.3% increase in the amount of coffee demanded. In this case, you can see that the responsiveness was not significant, as the 1% price drop resulted in only a 0.3 percentage point increase in quantity demanded. This means that if the price were to drop by 100 percentage points, the quantity demanded would increase by 100 percentage points. Still, the increase in coffee demand was only 30 percent, meaning the response was less than half; when the response is less than one, we normally call this inelastic because the reaction was very low in this case. So, wait a minute here, because the issue is that, suppose the price of a coffee decreased from \$1.70 to \$1.65. Earlier, we announced that we would increase the price from \$1.65 to \$1.70. Instead, what if we read the table the other way around: they reduce the price from \$ 1.70 to \$ 1.65? So, with all the other data remaining the same, when we perform an estimation here, we will obtain a different value. Instead of 0.3, we will get 0.311. That means the quantitative estimate, or elasticity estimate, differs when we use this point estimate with the formula we just presented and discussed.

Instead, we should avoid using the point estimate and instead use the midpoint of the arc elasticity estimates. In this case, however, it is acceptable.  $Q_2$  minus  $Q_1$ , which is  $dQ/dQ$ , is fine, but instead of using  $Q_1$  alone, we should take the average of  $Q_2$  and  $Q_1$ , that is,  $(Q_2$  plus  $Q_1)$  divided by 2. Similarly, for price, the denominator should be the average of  $P_2$  and  $P_1$ , which is calculated by adding  $P_2$  and  $P_1$  and then dividing by 2. This indicates that instead of calculating point elasticity, we are determining the midpoint or arc elasticity of demand.

Accordingly, here is the formula. Applying this formula yields the exact elasticity estimate, whether there is an increase or a decrease in the price of the same table. Therefore, we will get the exact estimate. These are different formulas for calculation. This is the one we mentioned at the beginning. It is also the formula widely used when estimating elastic demand from a table.

And if you are working with a huge dataset, the estimation method we use here becomes more difficult. Instead, we calculate the average slope,  $dQ/dP$ , from the dataset. Then, at a specific point, we analyze how elasticity changes when the price shifts from  $P$  to this new value, and we observe how  $Q$  changes as well, using the average  $P$  and  $Q$ . Since in a

demand curve, this is P, and this is Q, the slope reflects the rate of change between them. So, what we see here is  $\Delta p$  over  $\Delta q$ ; if you look at  $\Delta q$ , that's  $\Delta p$ , and that's  $\Delta q$ . The slope we find is  $\Delta p$  over  $\Delta q$ , but what we are measuring is  $\Delta q$  over  $\Delta p$ .

This means that the inverse of the slope is used in the calculation. The slope itself is part of the process, and to find the elasticity of demand, we need to take the inverse of the slope. Doing this gives us the formula to estimate the elasticity of demand. Similarly, if you perform this calculation on a linear curve, what you just calculated—for example, the change from a price of 120 at point G to 130 at point H—is one instance. You use the arc elasticity of demand to calculate demand elasticity, and you can repeat this from point B to point A as well. The result is that, on a linear curve, elasticity estimates differ at each point. For example, it's less elastic here, more elastic here, and both elastic and inelastic in other regions.

As you can see, the percentage change from point A to point B is 0. For a 1% change in price, the change in quantity demanded is 0.45%, which is less than half. This indicates that demand is inelastic. However, in contrast, you will find a value of minus 1.47. From this example, you can calculate the demand elasticity of the function  $q_d$  for  $40 - 2p$ . You need to note the current price, and when the price changes, you should plug that value into this equation and use the formula. This will show the change in quantity demanded. Concerning the properties of demand elasticity, it is a ratio of proportional changes; thus, it is a pure number independent of measurement units. Sometimes, it is reported as a negative number; other times, the negative sign is omitted because, when discussing the law of demand, it is understood to be negative. For practical purposes, however, you should report it in your calculations for exams.

Based on this estimate, using the observed elasticity, suppose the elasticity approaches infinity. Imagine a demand curve on a graph like this. If the demand elasticity is infinite, then a small change in price causes an infinite change in quantity demanded. This is called perfectly elastic demand. For example, at a certain point, a unit change in price causes no change in quantity demanded—meaning when the price is this much, even if it goes down, the quantity demanded stays the same. That's perfectly inelastic. These are the two extreme cases: perfectly elastic and perfectly inelastic, with unitary elasticity being the point where the curve's slope is 1. This means that roughly, when the price increases by 100%, the quantity demanded decreases by 100%. That results in an almost proportional response. If the response is unitary elastic, then inelastic means the estimated elasticity is less than 1 but greater than 0, while elastic means the estimated elasticity is greater than 1 but less than infinity. These are the five broad categories of price elasticity of demand. I have provided some slides on this. What is the use of understanding price elasticity of demand, especially for effective government policymaking? One purpose I mentioned is setting indirect taxes here.

The second one pertains to designing subsidy policies. Then, develop syntaxes and behavior change policies. These are different applications of understanding the price elasticity of demand, especially in policymaking. I also highlight some determinants of demand and the elasticity of demand. One is the availability of close substitutes. If goods have close substitutes, they tend to have more elastic demand, such as butter and margarine, which are easily substitutable.

A slight increase in the price of butter would cause a significant decrease in the quantity demanded because butter has substitutes. However, eggs lack close substitutes, so demand for eggs is likely to be less elastic than demand for butter. Similarly, insulin has no substitutes, making it highly inelastic. There are also differences between necessities and luxuries—necessities tend to have inelastic demand. For example, if the price of a doctor's visit increases, people will not significantly reduce the frequency of their doctor visits.

People still visit doctors because it is necessary. At the same time, the prices of luxury items, like international trips, are increasing. Naturally, the demand for these trips decreases significantly. The third aspect is how we define the market. For example, if we define the food market, since food is essential for survival, it generally has inelastic demand because there are no substitutes for it. However, within the food category, if we compare ice cream to other desserts, a change in the price of one can lead to substitution. Therefore, if the price of a dessert rises, people might choose more ice cream instead, reducing demand for the dessert. Similarly, in the short run, demand is less flexible because adjusting demand isn't easy—say, if the price of a gas cylinder increases, the quantity demanded won't decrease much immediately. However, in the long run, people often find alternatives, such as induction ovens or other electric options. Over time, more substitutes become available, making demand more elastic in the long run.

I have some examples here, which I calculated from the NSSO consumer expenditure data. You can interpret what this 0.5 means for the poor, but at the same time, it shows that the income velocity is very low for the wealthy. A one-unit increase in price causes only a 0.098% rise in pulse demand. This concept is known as the price elasticity of supply. Using the same formula and method, you can calculate it. Based on this, we can determine whether the supply of a good is elastic or inelastic. Similarly, in both the short run and long run, most goods and services tend to be inelastic.

But in the long run, it will become more elastic. I'm also providing an example of what happens when taxes are raised. You can do this as a homework exercise, share it with others, and show what will happen if a mayor imposes a one-dollar tax on each avocado in a city where avocados are sold. If 1,000 avocados are sold each day, will the city collect this many dollars in taxes per year? Not necessarily, because demand and supply change for that reason.

There will be changes. When the government imposes a tax, the price increases accordingly, causing consumers to feel the higher prices and leading to a decline in demand. Instead of selling 100 units, producers will now only be able to sell 50 units. This shows that when the price rises, the new quantity demanded increases to 500. From this, we see that the concept of elasticity of supply helps us better understand this situation. This concept of supply is also commonly applied in the labor market, particularly in discussions of labor supply.

Suppose there is a percentage change in the wage rate; what are the resulting changes in the quantity of labor supplied? This is one estimate. Denmark, as part of the EU, implemented tax relief in 2009 to attract more highly skilled immigrants and found that the elasticity of migration over the first two years following the reduction in the tax rate was significant. That means the decrease in tax led to a twofold increase in immigration to the country. To summarize, this is what we discussed regarding the concept of elasticity and its meaning. We then stated that the price elasticity of demand guides pricing and revenue strategies, taxation, and subsidy decisions, as well as consumer and public policy planning.

We also discussed various factors that influence demand elasticity. Then, we expanded this idea to include supply elasticity. Next, we distinguished between the short run and the long run. Overall, a solid understanding of demand and supply elasticity helps make smarter business and policy choices, depending on whether a product has elastic or inelastic demand.

Similarly, there are elastic and inelastic supplies. This information can help firms and governments make better decisions. Thank you very much, and I look forward to seeing you in the next session.