Whitepaper

A guide to price elasticity – the key to optimal prices

Read our comprehensive guide to learn everything you need to know about price elasticity of demand and its effects on retail pricing strategies.

7Learnings

AI-POWERED PREDICTIVE PRICING.

Table of Contents

Accurately measuring price elasticity in retail is key to any pricing optimization effort. Managers and online retailers need to understand the microeconomics of how customers respond to a price change in order to realize the full potential of pricing and price elasticity.

Based on price elasticity, it is possible to:

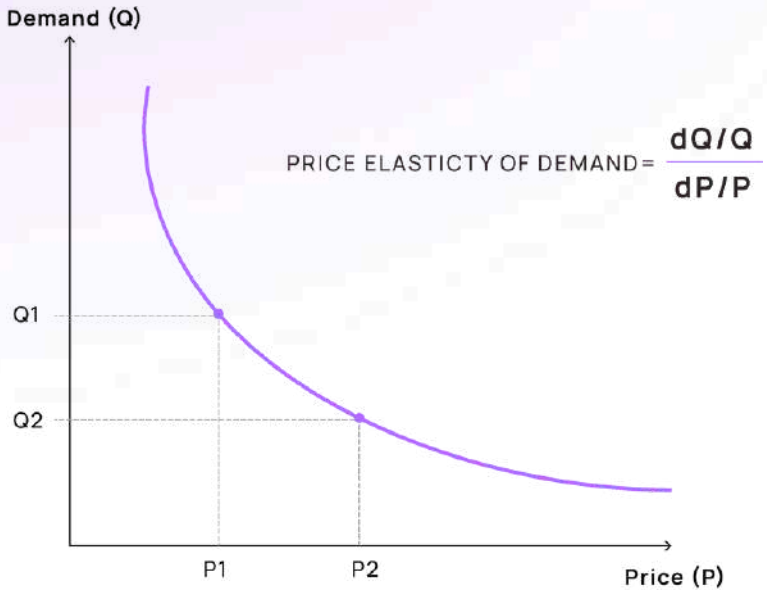
- Identify products that are important to your customers and therefore critical to building your price image.
- Identify products for which your customers regularly compare prices.
- Calculate profit and revenue scenarios for different price points of a single item or for a quantity of items, or your entire assortment.
- Create a demand function and chart a demand curve.
- Design an automated, optimized, and demand-driven pricing strategy.

So what is price elasticity? How is it measured, and how is it used for price optimization?

What is price elasticity?

Price elasticity measures how demand for a product changes after a price adjustment. Price elasticity can be calculated with a mathematical formula to produce a demand function, represented as a demand curve, which shows how often a product is sold at what price. At the same time, the demand function (or demand curve) can be used to determine how the demand for an item changes when the price is adjusted. Accordingly, it is a matter of the price elasticity of demand.

Most customers and most markets are sensitive to price changes. A price increase usually leads to a decrease in demand because customers do not want to spend more money on a product or service. A price decrease, on the other hand, usually leads to an increase in demand. This demand is called price elasticity because it can fluctuate depending on the price.



In this graphic, we can see the demand curve and the formula to calculate price elasticity of demand.

Optimal pricing by measuring the price elasticity of demand

Measuring price elasticity is difficult because, in general, companies do not operate under ideal test conditions. Often, not only are prices adjusted, but other internal and external factors that influence price elasticity, such as competitor prices or the weather (and thus demand), are changing at the same time. Moreover, price elasticities are not constant along the entire price demand curve. Good elasticities in particular tend to vary along the demand curve, and will typically tend to be higher (in absolute terms) near the prices of major competitors.

As it is not easy to measure price elasticity, many retailers resort to simpler methods of pricing. Often, they work with simple rule-based methods built from "if then" conditions. However, leading retailers are not satisfied with this and use price elasticities as a basis for pricing. To calculate these, machine learning-based algorithms are used, which in a first step measure the effect of price changes on sales. These algorithms also take into account a much higher number of other factors that affect customers' willingness to pay. More accurate price optimization based on the calculation of price elasticities leads to a significant increase in profit. In online retailing, companies such as 7Learnings have been able to prove this increase in profit using A/B tests.

Calculating the price elasticity of demand

When it comes to most products, consumers are sensitive to price changes and would buy less when the price increases. The price elasticity is then negative. We speak of positive price elasticity when a higher price leads to higher demand, which is rather rare and more likely the case in the luxury segment. To compare different goods and services, the price elasticity of demand is calculated by dividing the percentage change in demand by the percentage change in price:

$$\text{PRICE ELASTICTY OF DEMAND} = \frac{dQ/Q}{dP/P}$$

PED (price elasticity of demand) = (change in demand/change in price))

When price elasticity is high, demand is strongly related to price, as in the case of consumer goods of certain brands, e.g. a certain yogurt, or a branded sneaker. When price elasticity is low, demand and price are hardly related, as in the case of essential goods – for example basic groceries, gasoline or housing. Low price elasticity is also the case when there are no substitute products. Even with price increases, demand then remains relatively stable, which is referred to as price inelasticity. Thus, it is also important for price elasticity whether equivalent substitute products or substitute goods are available.

For the above demand function formula, this means that price elasticities in the retail sector are almost always negative: Demand is said to be elastic if the value of elasticity is above 1, and inelastic if it is below 1.

Price elasticity in trade: an example

In the following example, we apply the price elasticity formula to an online retailer of TV sets. The retailer decides to lower the price of brand X TV sets from 1,000 euros to 750 euros and assumes that this will increase the quantity of sales from 10,000 brand X TV sets to 20,000 sets per month.

Price	Quantity
1.000 EUR/ Device	10.000
75 EUR/ Device	20.000

Calculating the price elasticity

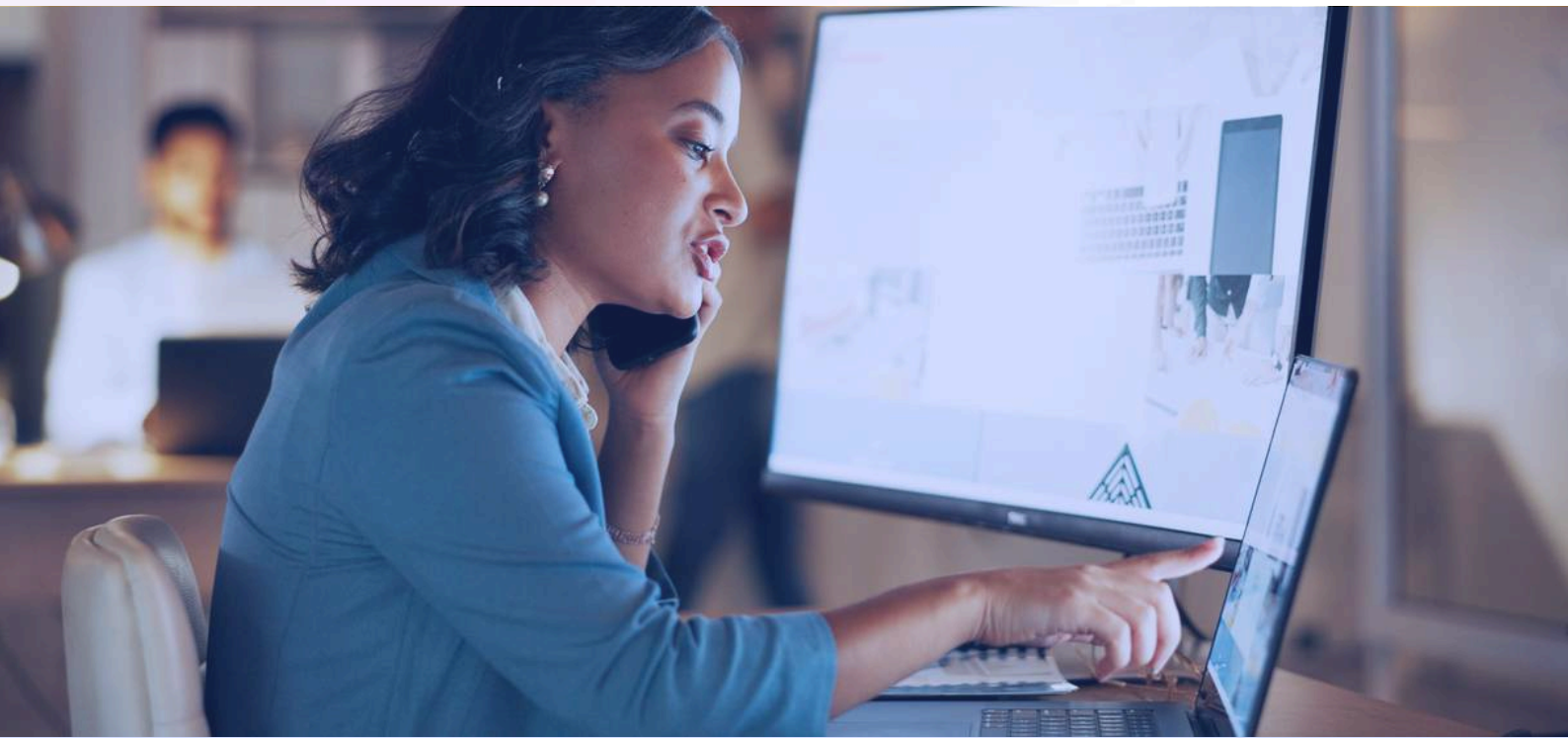
To calculate price elasticity, we look at the percentage change in quantity demanded and the percentage change in price.

% change in price = (750 euros – 1,000 euros) / (1,000 euros) = -25

% change in demand = (20,000 – 10,000) / (10,000) = +100 %.

From this follows: the price elasticity = 100 %/-25 % = -4

This means that demand is relatively elastic. That is, sales of the TV will change greatly if the retailer changes the price, whether up or down. The product is thus highly competitive for the retailer. If demand were not very elastic, a price change would have little effect on sales figures, and the product would have little competitive relevance.



Different Types of Price Elasticity of Demand

Types	What is it?	Effect on Revenue
Perfectly Inelastic Demand, **(PED = 0)**	• No change in demand for a change in price. • Demand remains constant for any value of price. • The demand curve is shown as a straight vertical line. • There is no product that has perfectly inelastic demand – most likely essential goods such as water, housing, or basic food items.	Price ↑ Revenue ↑ Price ↓ Revenue ↓
Relatively Inelastic Demand, **(PED = 0 < x < 1)**	• The percentage change in demand is less than the percentage change in price. • The demand curve is rapidly increasing. • A typical example is gasoline.	Price ↑ Revenue ↑ Price ↓ Revenue ↓
Unit Elastic Demand, **(PED = 1)**	• The proportional change in demand causes the same change in price. • The quantity demanded changes by the same percentage as the price change. • This can affect different products and services depending on the market situation, e.g. electricity (suppliers).	Price ↑ then No Change in Total Revenue Price ↓ then No Change in Total Revenue
Relatively Elastic Demand, **(PED = 1< x<∞)**	• The generated proportional change in demand is greater than the proportional change in price. • The quantity demanded changes by a greater percentage than the change in price. • The demand curve is shown to rise gradually. It is less steep than relatively inelastic demand. • Many consumer goods fall into this range.	Price ↑ Revenue ↓ Price ↓ Revenue ↑
Perfectly Elastic Demand, **(PED = ∞)**	• A small increase in price causes demand to fall to zero, while a small decrease in price causes demand to become infinite. • Consumers buy everything available at a given price, but nothing at any other price. • This is a theoretical concept because it assumes perfect competition, where the smallest price increase leads to zero demand.	Price ↑ then 0 total Revenue Preis ↓ then 0 total Revenue

Cross price elasticity of demand

Price elasticity measures the effect of price changes of one product on its own sales. But this is not the only relevant elasticity, as there are also interdependencies between products. These interdependencies are measured by cross price elasticity. Cross price elasticity of demand measures the percentage sales modification of a particular product that is demanded, relative to the change in the price of another product. In real world scenarios, this can be seen in how the price changes of certain products impact the demand for others.

Cross price elasticity can measure either complementary products, or substitute products. Being able to measure this can help retailers make informed decisions about their product assortments and the prices they set against their range. A negative cross price elasticity means that the two products are substitutes for one another, and the increase in price for one would lead to higher consumer demand for the other. Conversely, a product complement exists when the increase in the price of product #1 leads to a decrease in the demand for product #2, as the two products are used in conjunction with one another.

A practical examples of cross price elasticity for complementary products would be a decrease in the price of hot dogs, which would lead to an increase in the demand for hot dog buns. This would be considered a positive cross price elasticity of demand. Cross price elasticity is often used strategically by retailers in this scenario, to encourage sales of complementary products.

A common example of substitute products in cross price elasticity would be toothpaste. If the price of one brand of toothpaste increases, the demand for other brands of competing toothpaste would increase.

Factors affecting price elasticity in the retail sector

The price elasticity of a product is influenced by many factors. It is often not easy to identify them and measure their effect on price elasticity. In addition, factors change and therefore price elasticity does not have a constant value over time. The following items often have a direct impact on the price elasticity of an item or service:

Type of product:

Necessary goods and commodities (inelastic)

- Goods that are essential to life are usually inelastic, meaning that a change in price has little effect on demand. For example, if the price of gasoline goes up, demand doesn't change too much because people still need to use their cars to get to work.
- Other examples include textbooks or prescription drugs.

Comfort goods and commodities (more elastic)/Luxury goods and commodities (quite elastic)

- Products that show more price elasticity are ones that make life more enjoyable and pleasant, such as a television or a gym membership.
- In the case of pleasure and luxury goods such as a sports car or a diamond ring, taste also plays a role – after all, these products are basically not essential to life.

Income and economy

- The average income of a consumer group or an economy also influences the price elasticity of demand for goods and services.
- If the economy is in a downturn, the decline in annual income for the majority of the population may cause luxury items to have more price elasticity.
- A recession causes consumers to save rather than spend money on luxury items.

Competition and substitutes/substitute products.

- The more competition or the higher the quantity of substitute products there are, the more elastic demand is because consumers can easily switch.
- For example, if the price of Bavarian asparagus has increased because of bad weather and poor harvest, but asparagus from Spain is an equivalent competing product in taste, quality, and price, then consumer demand for it will increase.

Product life cycle

- For new products, the price elasticity of demand is low because there is little or no competition in the market.
- In contrast, the long-tail SKUs or items with price discounts have more price elasticity.

Level of price

- For most products, price elasticity is not the same for all prices.
- Often, high-priced products have more price elasticity because customers put more thought into the purchase and investment – they are also more likely to compare prices with competing products.

Retailer brand and service

- The price elasticity of a product interacts with the rest of a retailer's offering.
- If, for example, a retailer offers a bonus program or particularly good delivery conditions, customers are less likely to switch and will buy even if prices are higher – thus reducing price elasticity.
- A retailer's brand can also have a positive or negative impact on price elasticity.

This list of factors is not exhaustive. Many other points, such as the position in the shopping cart, can influence price elasticity.

8

Price elasticity during the COVID-19 pandemic

In times of increased demand for certain products, retail price elasticity becomes very evident, as in the case of toilet paper. There are no substitutes or substitute products for toilet paper.

While toilet paper is generally available at a low price, consumers virtually hoarded it during the initial 2020 coronavirus lockdown. Because of the lack of substitutes, attitudes toward price elasticity changed: in normal times, consumers view toilet paper prices as something elastic – if the price of a particular brand rises, they can turn to alternatives.

However, when the price rises and competing products are sold out, the price elasticity of demand becomes inelastic: people also pay a higher price.

Intelligent pricing strategies with machine learning-based pricing software

For the optimal calculation of price elasticities, leading retailers today use **machine learning algorithms**. This method is considered best practice because it extracts as much information as possible about price elasticity from the quantity of available data. Conventional approaches to pricing only consider about three to five different factors. Software that uses the latest generation of neural networks can take into account all relevant factors to determine price elasticities. Compared to simpler rule-based pricing, this leads to better results and enables more differentiated pricing.

To infer price elasticity from existing transaction data, prices must have changed in the past. The latest generation of machine learning-based pricing software is capable of learning across product groups or clusters. In this case, not every item needs to have a history of price changes to determine its price elasticity. Nevertheless, measuring price elasticity via demand functions remains a challenge for retail segments with a high quantity of seasonally changing assortments, such as in the fashion industry.

7Learnings

AI-POWERED PREDICTIVE PRICING.

Elevate your Business with Predictive Pricing

Schedule a Demo and see first hand the insights that our leading clients are leveraging with 7Learnings.

www.7learnings.com
info@7Learnings.com
Engeldamm 64 10179 Berlin,
Germany