

Economic Order Quantity (EOQ)



ECONOMIC ORDER QUANTITY

The equation and explanation.

Table of Contents:

[The Derivation of EOQ Formula: ~formula derivation source: Wikipedia~](#)

[Example of Economic Order Quantity \(EOQ\)](#)

[The Factors that Economic Order Quantity \(EOQ\)](#)

[#1 Reorder Point](#)

[#2 Purchase order lead time](#)

[#3 Purchasing cost per unit](#)

[#4 Stockouts](#)

[#5 Quality costs](#)

[#6 Demand](#)

[#7 Relevant ordering cost](#)

[#8 Relevant carrying cost](#)

[Importance of Economic Order Quantity \(EOQ\)](#)

[Why should you be calculating EOQ?](#)

[Minimize Inventory Costs](#)

[Minimize Stockouts](#)

[Limitations of Economic Order Quantity \(EOQ\)](#)

[Conclusion](#)

The company's reputation and profitability are always at stake if it has too much or too little inventory on hand. 43% of business owners have considered "overbuying inventory" as a challenge, whereas 36% said the same for "underbuying inventory".

To provide a solution to this, in 1913, Ford W. Harris designed a model of "Economic Order Quantity (EOQ)" through an explanation. This was later turned into a mathematical equation by R.H. Wilson, a consultant who applied it extensively.

*The Economic Order Quantity is a very good approach for **efficient inventory management**, though not the only step that a merchant can take, but can certainly make an impact.* (punchline)

The Derivation of EOQ Formula: [~formula derivation source: Wikipedia~](#)

Variables:

T = Total annual inventory cost

P = Purchase unit price, unit production cost

Q = Order quantity

Q* = Optimal order quantity

D = Annual demand quantity

K = Fixed cost per order, setup cost

h = Annual holding cost per unit, also known to be carrying or storage cost

The single-item EOQ formula helps find the minimum point of the following cost function:

Total Cost = Purchase Cost or Production Cost + Ordering Cost + Holding Cost

Where,

- Purchase cost: This is the variable cost of goods: purchase unit price \times annual demand quantity. This is $P \times D$
- Ordering cost: This is the cost of placing orders: each order has a fixed cost K, and we need to order D/Q times per year. This is $K \times D/Q$
- Holding cost: the average quantity in stock (between fully replenished and empty) is $Q/2$, so this cost is $h \times Q/2$

$$T = PD + K \left(\frac{D}{Q} \right) + h \left(\frac{Q}{2} \right)$$

To determine the minimum point of the total cost curve, calculate the derivative of the total cost with respect to Q (assume all other variables are constant) and set it equal to zero (0):

$$0 = - \left(\frac{DK}{Q^2} \right) + \left(\frac{h}{2} \right)$$

Solving for Q gives Q* (the optimal order quantity):

$$Q^{*2} = \left(\frac{2DK}{h} \right)$$

Therefore,

$$Q^* = \sqrt{\frac{2DK}{h}}$$

Can also be written as,

$$EOQ = \sqrt{\frac{2(\text{Annual Demand} * \text{Cost per Order})}{\text{Annual holding cost per unit}}}$$

ECONOMIC ORDER QUANTITY

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Example of Economic Order Quantity (EOQ)

Let's assume, a retail clothing shop is into men's jeans and sells roughly around 1000 pairs of jeans every year. It takes \$5 for the shop to hold a pair of jeans for the entire year, and the fixed cost to place an order is \$2.

As per the EOQ formula, the calculation of the above-mentioned scenario is below:

$$\text{EOQ} = \text{Sq. root} [(2 * 1000 \text{ pairs} * \$2 \text{ order cost}) / (\$5 \text{ carrying cost})]$$

Therefore, EOQ = 28.3 pairs.

The ideal order quantity for the shop will be 28 pairs of jeans. Simple!

The Factors that Economic Order Quantity (EOQ)

#1 Reorder Point

It is the time when there occurs a need to reorder another set of stock or replenish the existing stock. EOQ always assumes that you order the same quantity at each reorder point.

#2 Purchase order lead time

This is the time period from placing the order until the ordering is delivered. EOQ assumes that the lead time is understood.

#3 Purchasing cost per unit

The cost per unit never changes, over the period of time, even though the quantity of the order is changed. EOQ always assumes that you pay the same amount per product, every time.

#4 Stockouts

There are no chances for stockouts. You have to always maintain enough inventory to avoid stockout costs. This clearly states that you always have to strictly monitor your customer demand along with your inventory levels, carefully.

#5 Quality costs

EOQ never focuses on the quality costs, rather the carrying costs.

#6 Demand

It's about how much the customer wants the product for a specific time period.

#7 Relevant ordering cost

The cost per purchase order.

#8 Relevant carrying cost

The cost involved in the entire maintenance and carrying the stock, for the specific period.

Importance of Economic Order Quantity (EOQ)

The Economic Order Quantity is a quantity designed to assist companies to not over- or under-stock their inventories and minimize their capital investments on the products that they are selling. The cost of ordering an inventory touches down with an increase in ordering in bulk. However, as the seller wishes to grow the size of the inventory, the carrying costs also increase.

The EOQ is exactly the point that optimizes both of these costs i.e. cost of ordering and the carrying costs which are inversely related.

Now, with this...

- The business owners can easily order the right quantities and reduce the ordering and carrying costs. This will eventually result in either profits or a balanced business.
- Decision making can be made smoother, with less time and effort wasted.
- Right vendors can be chosen, with the right packages to save costs and earn better profits.

Why should you be calculating EOQ?

There are several benefits of calculating EOQ that can impact your business. It shows and lets you maintain your supply chain while keeping the costs down.

Minimize Inventory Costs

There are high chances of booming storage costs if you plan to store any extra inventory. High inventory costs depend majorly on how you order, if there is anything that is damaged, the number of products that lie there not getting sold. If you are constantly re-ordering products that have a very low velocity, EOQ can help you analyze how much to order in a certain period.

Minimize Stockouts

By calculating how much inventory you need on how much you are planning to sell, EOQ will help you avoid stock-outs without having too much inventory on hand for too long. It can definitely be surprising enough to see that ordering in small quantities can be way more cost-effective, but this can turn the other way as well - calculating EOQ for your products can help.



Calculate EOQ
For Every Product

Minimize Inventory Costs
Save More!



Limitations of Economic Order Quantity (EOQ)

The EOQ formula always works on an assumption that the consumer demand is constant.

It becomes difficult or nearly impossible for the formula to work when it comes to business events such as changing consumer demand, seasonal changes in inventory costs, or purchase discounts a company might look out for at the time of buying larger quantities.

Not at all designed to consider any fluctuation in the order quantity or carrying costs.

The basic EOQ model always assumes that you are selling just one product. So, as a seller, if you are selling multiple products, you need to calculate and track all your products separately.

Conclusion

Economic Order Quantity might not consider all the factors that affect business but is still a powerful tool if it sits right for you.

Calculating the Economic Order Quantity (EOQ) for your business can help you to analyze better, order better, and eventually earn better.