What Is Economic Order Quantity?

Economic order quantity refers to the number of units a company needs to have in their inventory with every order to minimize their overall cost of inventory. Otherwise known as the EOQ, this figure is used as a part of reviewing the inventory system.

The level of inventory is constantly monitored and a fixed quantity is ordered every time the inventory level reaches the specific reorder point.

The economic order quantity model makes it easier for businesses to calculate the appropriate reorder point in the optimal reorder quantity to ensure that inventory remains in stock at all times.

It is a valuable tool for small businesses to have to make decisions about how much inventory they need to keep available, how many items to order every time, and how often they need to reorder the items to keep their costs as low as possible.

The EOQ model however isn’t perfect for every small business. It assumes that your demand remains constant and that your inventory depletes at a fixed rate until it reaches zero. Once it hits that point, a specific number of items are restocked instantly and inventory reaches its beginning level.

Because the model assumes instantaneous replenishment, there aren't shortage costs factored in.

Lead time is another factor. When reordering, you need to make sure you have enough product on hand to cover your needs until the next order arrives. It's also difficult to use when you are dealing with variable costs. As a result, the cost of inventory with the EOQ model involves a trade-off between your inventory holding costs and order costs.

Your inventory holding costs, or carrying costs, refer to the cost of storage and the cost of the capital that's tied up in your inventory rather than being invested or used for other purposes. Your order costs are any fees associated with placing your orders such as delivery fees.

Ordering a large amount of inventory at one time increases your holding costs. Making more frequent, but smaller orders a few more items reduces your holding cost but increases your overall ordering cost.

The EOQ aims to find the right quantity to balance these costs and keep them as low as possible. But before you can find your EOQ, you must first calculate the Total Inventory Cost.

Total Inventory Cost Formula

TC = PD + HQ/2 + SD/Q where:

TC = Total Cost

P = Price per unit

D = Demand, or the total number of units purchased every year

H = Holding cost per year

Q = order quantity every time you place an order

S = fixed cost of each order

Cake Decorating Business Example

Let’s say your cake decorating business uses 2,000 units (D) of sugar every year. It’s used in nearly all of your product offerings, so it’s mission-critical.

Let’s assume your unit cost is $2. (P)

Your holding cost per unit per year is 50 cents. (H)

Q is the quantity ordered each time an order is placed. Let’s assume you order 200 units per order.

S is the fixed cost of every order (Sugar isn’t the only thing you’re ordering from your suppliers every week), let’s assume $10 per order.

Calculating the total cost with these values, we determine that you spend $4,150 on your sugar inventory every year.

The main variable here is order quantity. If you decide to purchase less sugar in each order, you’ll have more fixed order expenses, but you’ll have lower holding costs.

Let’s look at it with a 100 unit order at a time.

The additional fixed order costs mean that you’re now spending $4,225 on your sugar inventory.

So now, let’s try a 300 unit order.

The change in holding and order costs means that you’re spending $4141.67, for a total of about $9 a year from your first order.

But instead of randomly choosing order amounts to plug into this formula to determine what works for you, the EOQ tells you how much you should order each time.

Your ideal order quantity comes when the HQ/2 and the SD/Q are equal.

The EOQ Formula

With the economic order quantity formula, you need three variables: holding costs, demands, and order costs.

Holding Costs

Your holding costs are the total amount of money you spend storing your inventory.

For this formula to be effective, you first need to calculate your annual holding costs. Do this using this formula:

(Storage Costs + Employee Salaries + Opportunity Costs + Depreciation Costs) / Total Value of Annual Inventory = Holding Cost

Demand

To calculate your annual demand, you must know how much demand there is for your product every year. Your historical data helps you to determine how much of a particular product you're selling year-over-year.

If you do not have historical data because you are a brand new company, use the data you have available and estimate it for the year based on how much time has passed.

The more data you have available, the better overall. Changes in customer demand aren't easy to factor in when calculating EOQ.

Order Costs

Your annual ordering cost is the amount you spend on an order every time you buy it. This is calculated on a per order basis and always includes the shipping and handling costs.

Once you have those variables, you can plug them into the EOQ formula and determine what your economic order quantity is for any particular item.

Calculate the order quantity by multiplying the total number of units by the fixed

ordering costs. 2000×10 = 20,000. Multiply that number by 2 and get 40,000. Divide that number by the holding cost (.50) and get $80,000.

Now, we take the square root of that number and get 282.84. Since we can't order .42 bags of sugar, we'll round it up to 142. That means, instead of ordering 100, 150, or 200 bags of sugar, we'd round up to 283 for Q.

That means you'd order sugar fewer times overall, placing an order for 283 units every time. It'd bring your total cost of inventory down to $4141.42 for the year. Though it doesn't seem like much savings – if you went through this practice with every ingredient you had to carry in your kitchen, the savings would be rather significant.

How Supplier Quantity Discounts Affect EOQ

You'll find that your EOW will change as a result of quantity-based discounts that suppliers may offer you as an incentive for larger orders. For instance, a vendor may charge $3 per unit on orders of less than 100 units, and only $1.50 per unit on orders of more than 200 units.

Though on the surface it seems like it makes sense to buy more at a lower price per unit, you need to calculate the total cost of inventory for the EOQ and price points above it. Then, you have to choose the order quantity that provides the lowest total cost.

It's worth noting that EOQ calculations are not as simple as we've shown in the example above. The intent is more on the main purpose of the formula, rather than its practical application in business. If you deal with fluctuations in consumer demand or changes in the cost of raw materials, it may be difficult to get a solid EOQ that you can rely on.

If you're a small business with a large inventory that frequently turns over, you may be better off looking at inventory management software that applies the EOQ concept in a way that more closely matches the complexity of your real-world situation. This can help make your purchasing decisions more dynamic for better inventory control.

In our cake decorating business example, we didn't look at the inventory costs associated with flour, food coloring, butter, eggs, decorating tools, piping bags, etc. We looked at a single item. Considering how often you use certain things, and how little you use others, everything in your inventory will have different reorder rates and points. To optimize your entire inventory, you'll have to run EOQ for every item in your inventory.

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