Business Markups

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When I was a boy, I worked in my father's boat store. I remember a discussion with my dad once about how the cost of a boat needs to be marked up an amount larger than the profit you wanted to make. When I asked my dad about it, he just referred me to a table that businessmen used (i.e., he wouldn't explain it).

Here's an example. Suppose you are a businessman and you buy an item for $2. You want to make a profit of 30% on the item. What should the selling price be?

The naive approach would be to just add 30% to the cost, but that's clearly wrong. The reason is that profit is always calculated on the selling price, but markup is calculated on the cost. Thus, you're doing percentages with different bases.

In later years, I worked out the formula for this because I wondered where the table came from. It's not hard to derive and is so fundamental to buying and selling, I'll give the derivation here. You may be surprised to see it's just simple algebra that you learned in your freshman year of high school.

Let's use the following symbols:

- C = cost of an item
- S = selling price of an item
- P = profit, usually given as a fraction of the selling price
- M = markup, usually given as a fraction of the cost

With these definitions, we have the two fundamental equations (really, they're just the definitions of these quantities)

$$S = C(1+M) \tag{1}$$

$$C = S(1-P) \tag{2}$$

What we want is the relationship between M and P. To get this, substitute the expression for S from equation (1) into equation (2)

$$C = C(1+M)(1-P)$$

The C's cancel out from each side to yield

$$\begin{aligned} 1 &= (1+M)(1-P) \\ 1 &= (1+M)-P(1+M) \\ -M &= -P(1+M) \\ P &= \frac{M}{1+M} = \frac{1}{1+\frac{1}{M}} \end{aligned}$$

where I have written each step out to make it easier to follow (if you're confused by the last step, I just divided both the numerator and denominator by M). Since we know neither P nor $1+\frac{1}{M}$ will be zero, we can take the reciprocal of each side to get

$$\frac{1}{P} = 1+\frac{1}{M} \qquad \text{or} \qquad P = \frac{M}{1+M} \tag{3}$$

This is the fundamental equation relating profit P based on selling price and markup M based on cost. I suggest you memorize either of these equations.

If you solve equation (3) for M in terms of P, you'll have

$$\frac{1}{M} = \frac{1}{P} - 1 \qquad \text{or} \qquad M = \frac{P}{1-P} \tag{4}$$

Let's look at some examples. Suppose we want 25% profit on selling price. This means $P = 0.25 = \frac{1}{4}$.

Putting that in equation (4), we get M = 1/3 or 33%.

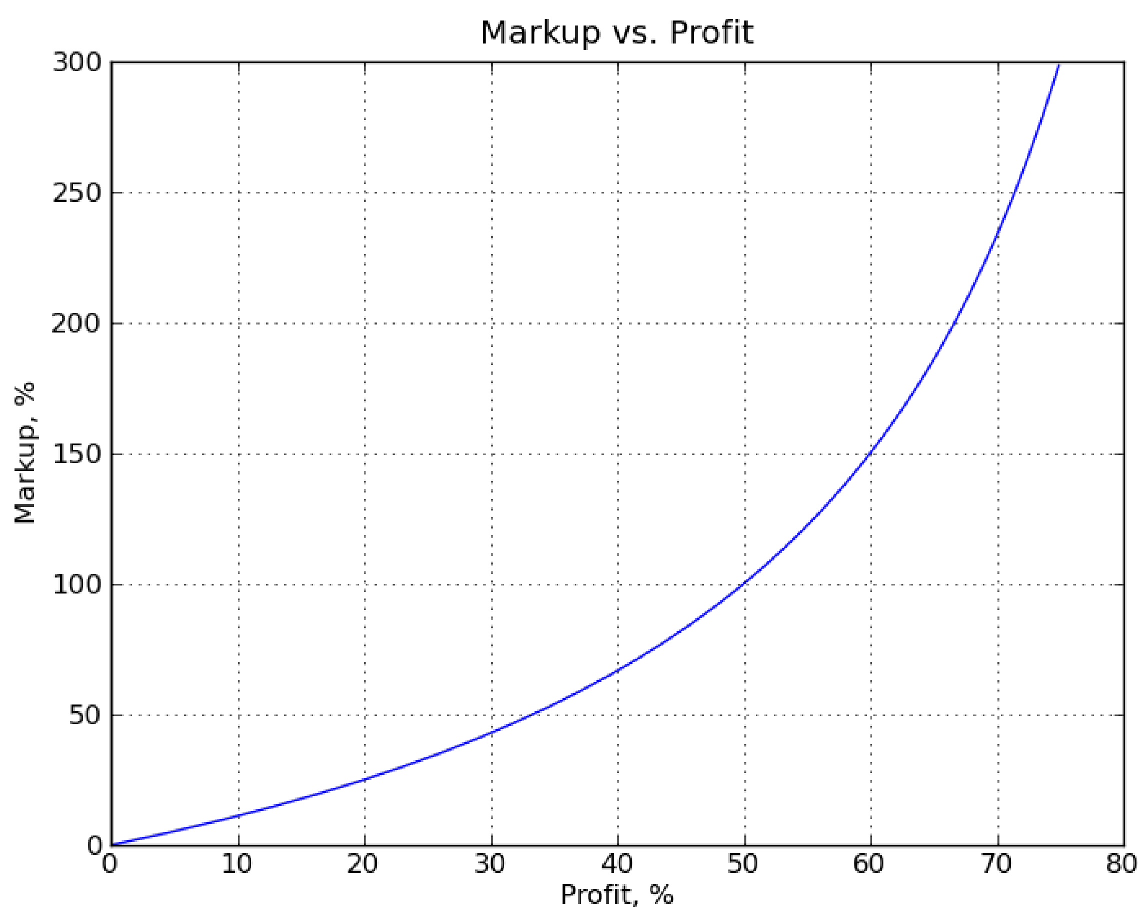
Check that result with a real example. Suppose I buy an item for $6. I thus need to add 1/3 of this to the cost to get the selling price to make 25% profit. Thus, the selling price is $8 and the profit is $2, which is 25% of the selling price. Yep, it works.

Suppose we want 100% profit. Putting that in equation (4) yields $\frac{1}{M} = 0$. Thus, we'd have to make the markup infinitely large to make everything profit, so that gives a sensible bound.

My father's business used tables for this, but I've seen various tools over the years for it. One popular one was a circular slide rule where you set the profit you wanted against the cost and read off the selling price.

But now that you know the formula and you'll often have a calculator handy, there's no need for any other tools. See, that algebra you slept through is occasionally useful! ☺

Here's a plot of the relationship:



Multipliers

At a company I used to work at, it was common to talk about the multiplier of a product, as this quickly gave one a feel for the success of product development's and marketing's efforts in bringing the product to market. This was a number m where

$$m = \frac{S}{C}$$

In other words, it was the ratio of selling price to cost. Preferred products had large multipliers; sometimes they could be 5 or higher; I remember one product had a multiplier of nearly 100.

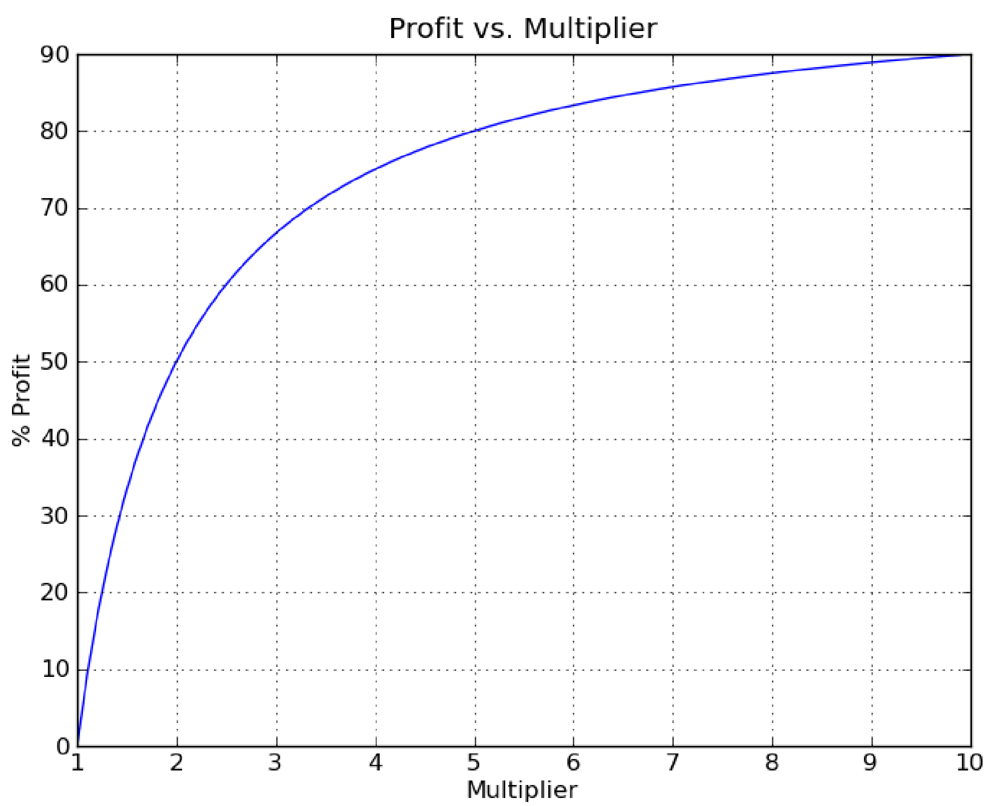
We can quickly derive what the profit P is given this definition of m by substituting $S = mC$ in equation (2); the result is

$$\boldsymbol{P = 1 - \frac{1}{m}}$$

and

$$\boldsymbol{m = \frac{1}{1-P}}$$

If you use multipliers, this could be worth memorizing. You can see that you approach 100% profit as m grows without bound. Here's a plot that shows the behavior:



Many retail outlets have to work with profits on the order of 1/3 (or less) to be competitive and survive (I've read that the car manufacturers have to live with profits of a few percent!). You can see that their multiplier at this level is 1.5 (and, you can immediately see that means a markup of 50%). That product with a multiplier of 100 had a profit of 99%. However, this product's cost was a manufacturing cost and didn't include the cost of product development, research, and licensing fees. These costs were significant for this family of products, as the actual product delivered was a ROM chip on a PC board with an edge connector, all encased in plastic.

Businesses jealously guard their multiplier information, for a variety of reasons. Shopping on the web today makes it easier to find out about these multipliers, as you can often find the same product from different vendors and find large variations in pricing. A relative who used to work in retail jewelry stores said that a common multiplier for jewelry products was 4, which means they don't pay their suppliers much. A friend reported a similar situation when he sold a product he developed to a large mail-order business.

Slide rule calculations

You can buy dedicated slide rules to perform these markup and profit calculations and they are handy for a business. However, these calculations are easily done with a regular slide rule and this method is typically faster than using a calculator. If the usual 3 significant figures in the answer from a slide rule are suitable, then this is all you need. Here's an example with a cheap 6-inch Sterling plastic slide rule.

Suppose I decide to mark something up by 80%. What's my profit? Equation (3) is

$$P = \frac{M}{1+M}$$

which shows us how to solve it with a slide rule: put M on the C scale and 1+M on the D scale. Then read P on the C scale opposite the 1 on the D scale. Thus, I put 80 on the C scale opposite 180 on the D scale and read 44.5% profit on C opposite the 1 on the D scale.

Note it's easier to work with percentages because then it's more likely we'll do integer arithmetic and can do it in our heads more easily. The slide rule just works with the significand anyway.

Solving equation (4) for a required markup is just as easy. If I want 40% profit, to find the markup, I set 40 on the C scale and $100-40=60$ on the D scale. Opposite the 1 on the D scale I read 66.6%. In other words, marking up by 2/3 gives 40% profit, as you can quickly see from equation (3)

$$M = \frac{2/3}{1+2/3} = \frac{2}{3}\left(\frac{3}{5}\right) = 0.4$$