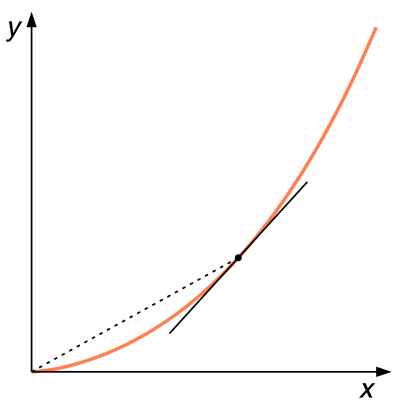
Preappendix: Elasticity and the Marginal Cost Curve

In our initial economic primer we said nothing about the concept of elasticity or about the marginal cost curve, which have little role in the *General Theory* except in connection with its theory of prices. We therefore now briefly summarise these two topics, encouraging the knowledgeable reader to skip directly to the main Appendix.

I. Elasticity

Useful properties of economic functions can often be expressed in terms of elasticities. If y is a function of x then the **elasticity** of y with respect to x is

$$\frac{x}{y}\frac{\mathrm{d}y}{\mathrm{d}x}.$$



An elastic function.

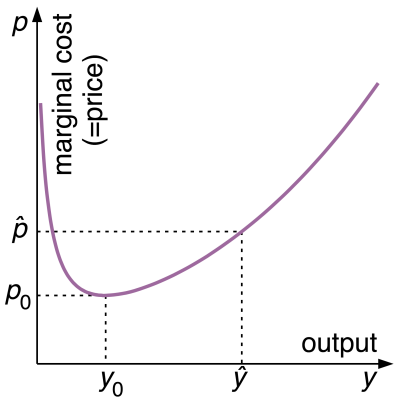
The elasticity of a function at a point is its gradient at that point divided by the gradient of a straight line from the origin to the point.

If a function increases faster than in proportion to its parameter, then it will be steeper at any point than the line from the origin to that point: its elasticity will therefore be greater than 1.

It is easy to show that the elasticity of x^n with respect to x is n, and that the price elasticity of *supply value* is 1 greater than the price elasticity of *supply*.

II. The Marginal Cost Curve

The marginal cost curve may be defined for a firm or for an industry as a whole. We look first at its application to a single firm.



The marginal cost curve.

The **marginal cost curve** shows the cost p per extra unit of output when the real output is y. Under perfect competition, and looking at the short term, it will always be an increasing function of y for large enough y,[1] but usually it will be a decreasing function for small y.

We may consider the case of an iron furnace. It may have no way of producing an ounce except by producing a ton and discarding the rest, so low outputs will be expensive. As the quantity increases, the point is reached at which the output is y_0 and all factors of production are being used in their most efficient way; the marginal cost is therefore minimised. If the furnace is to produce more output still, then it will need to adopt more intensive practices: round-the-clock working, destructive use of components, etc. The cost per unit will increase, and at a certain point increased production will become almost impossible.

A decreasing marginal cost curve corresponds to the case in which it is more profitable for the industry to concentrate production in a smaller number of factories. Therefore, if the curve does not eventually increase, the natural condition for the industry is one of monopoly.

Under perfect competition there are many firms with the same marginal cost curve. The price of any good sold will be its marginal cost because if one firm tries to sell at a higher price,

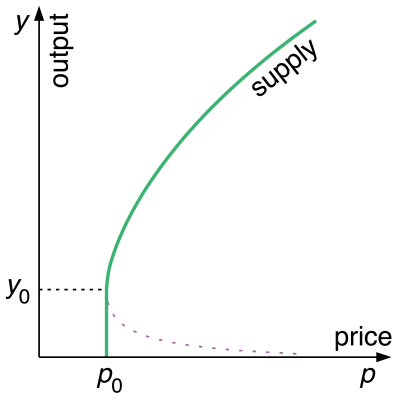
1. Sraffa's 1926 criticisms of Marshall's doctrine of increasing marginal costs refer to the *long term* behaviour of the curve in which capital and labour are expanded *pari passu*; Keynes is considering the short term in which the stock of capital is fixed.

then another firm can steal its market at a profit by halving the difference.

If each firm operates at a point $(\hat{y},\hat{p})$ then its revenue will be $\hat{y}\cdot\hat{p}$ whereas its costs will be the area under the marginal cost curve from 0 to $\hat{y}$. Therefore the firm covers its costs only if $\hat{p} \geq$ the average value of the marginal cost curve between 0 and $\hat{y}$ (which cannot happen on the decreasing part of the curve). If costs exceed revenue then the firm would be better off shutting down (i.e. moving $\hat{y}$ to 0). Hence for firms or industries in operation the integral of the marginal cost curve must be $\leq \hat{y}\cdot\hat{p}$ and the operating point must be on the rising leg of the marginal cost curve.

The marginal cost curve for the industry will have the same general characteristics as the individual marginal cost curves. It may differ in detail (if we don't assume that there are infinitely many firms) because low outputs will be satisfied by some firms closing down while others stay in operation. As output increases the gradient of the curve will fluctuate discontinuously as new firms come back into production; and once all firms are operating normally, the overall curve will be equal to the sum of individual curves.

If we look at the ascending leg of the marginal cost curve for the industry as a whole, we see that it shows marginal cost as a function of output; but marginal cost is price, so this leg of the curve is the inverse of the function giving output as a function of price, i.e. of the (short-term) supply curve. The falling leg, on the other hand, has no significance in terms of supply. Thus the supply curve shown above right corresponds to the marginal cost curve on the facing page. The properties of the supply curve are properties of the marginal cost curve (*mutatis mutandis*, of course).



The supply curve.