The Elgar Companion to Radical Political Economy

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Costs of production

This entry focuses on the definition of cost and on the problem of changes in costs in relation to the quantity produced. Cost is defined as the value of the resources needed for an economic operation.

In Marx the value of goods is given by the quantity of socially necessary labour, that is, the 'average' quantity of labour needed for producing in normal conditions. The quantity of socially necessary labour is considered the 'real cost' and is regarded as both the substance and measure of exchange value. 'Capitalist cost' corresponds only to the anticipated capital, obtained by adding up the costs for the raw materials and equipment wear and tear (constant capital), and the costs for wages (variable capital).

The definition of 'real cost' is abandoned by Sraffa (1960) even though, in his rigorous theory of relative prices he does take up the classical concepts of reproducibility, surplus, circularity of production and free competition (assumption of freedom of movement of financial capital and uniform rate of profits). In Sraffa's model, input and output prices are determined by a simultaneous equations system. Consequently, there is a reciprocal interdependence between cost and price for all commodities which enter (directly or indirectly) into the production of all commodities. Sraffa prefers to avoid the term 'cost of production' because this term has come to be 'inseparably linked with the supposition' that it stands for quantities that can be measured 'independently of, and prior to, the determination of the prices of the products' (Sraffa, 1960, pp. 8–9).

The problem of variations in costs in relation to changes in the quantity produced is analysed by the classics. Decreasing costs are discussed in relation to technical change and the division of labour (Adam Smith's dynamic increasing returns), while increasing costs are tied to the scarcity of fertile land and are considered within Torrens and Ricardo's theory of

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land and are considered within the theory of income distribution (Malthus, Torrens and Ricardo's theory of rent).

Marx shares Ricardo's belief that 'if all circumstances remained unchanged', the increased quantity produced of a good would make for constant average production costs. But in the capitalist system, the social and technical conditions of the labour process are continuously being revolutionized in order to get higher profit by raising the productivity of labour. Dynamic increasing returns are obtained by improving equipment and by augmenting, at the same time, the dimension of scale.

It is self-evident that productivity increases, resulting from variations in the size of *a single firm*, are incompatible with a static theory of perfect competitive equilibrium. If an individual firm can decrease its average costs by increasing production, 'it will obtain a monopoly of the whole business of its trade' (Marshall, 1890, p. 380; Sraffa, 1925, pp. 41–2). Therefore, in perfect competition there may be increasing returns internal to industry, but they have to be external to the firm. It *must* be assumed that the individual firm operates with diminishing returns to scale beyond a certain point (U-shaped long-period cost curves).

As far as the collective supply curve is concerned, Sraffa showed that neither rising nor decreasing long-period industry supply curves are compatible with the static partial equilibrium analysis in perfect competition. In fact, the collective long-period supply curve may increase or decrease only if input prices rise or fall with a change in the total quantity supplied. But in a partial equilibrium analysis, input price variations cannot be considered because input prices are given as parameters. In short, as the hypothesis of *ceteris paribus* imposes, the supply curve of a commodity must be independent of demand and supply conditions of all other commodities, inputs included. If the price of inputs is assumed as a parameter and each firm produces the optimal quantity, the long-period collective supply curve will be horizontal, because the quantity supplied can only be increased with the entry of new firms operating with optimal plant. With a horizontal long-period collective supply curve, cost determines price, while demand determines quantity (Sraffa, 1925, pp. 56ff; 1926, p. 541].

Sraffa notices some contradictions between these *logical conclusions* (U-shaped individual firm long-period average cost curve in perfect competition and horizontal collective long-period supply curve in partial analysis) and the *empirical evidence*.

Firstly, increasing returns external to the firm and internal to the industry are quite rare phenomena in modern industry, where industrial firms usually operate with diminishing internal total unit costs. Consequently, the limit of firm expansion does not arise from costs, but from the difficulty of selling a larger quantity of goods without reducing their price.

Secondly, Sraffa observes that an industry may turn out to be characterized by an increasing or decreasing supply curve according to the definition of 'industry' adopted:

> the wider the definition which we assume for 'an industry' – that is, the more nearly it includes all the undertakings which employ a given *factor* of production, as, for example, agriculture or iron industry – the more probable will it be that the forces which make for diminishing returns will play an important part in it; the more restrictive this definition – the more nearly it includes, therefore, only those undertakings which produce a given type of consumable *commodity*, as, for example, fruit or nails – the greater will be the probability that the forces which make for increasing returns will predominate in it (Sraffa, 1926, p. 538).

In conclusion, 'it is very difficult to classify the various industries' according to whether they belong to one or the other category (ibid.).

Sraffa's critique led him to formulate his theory of relative prices independent of the partial equilibrium method, of the concepts of 'supply and demand curves' and, more generally, of the marginalist analysis itself. In his theory no hypothesis on returns to scale is required because Sraffa leaves the volume of production unchanged (Sraffa, 1960, p. v). The assumption of given quantities produced enables the formulation of a consistent theory of relative prices based on production conditions and on income distribution. It excludes the possibility of studying, *within the same theory*, (i) the variation of costs in relation to the quantity produced, (ii) the behaviour of the firm and (iii) the changes in techniques and in demand for the final goods. This entails a distinction between the theory of relative prices on the one hand, and theories of the behaviour of the firm and innovative processes on the other. This analytical separation does not necessarily imply incompatibility between the various non-neoclassical lines of research which focus on different analytical issues (Roncaglia, 1991, pp. 205–6).

From the 1930s on many scholars started analysing the costs of the firm in a non-neoclassical context. Empirical investigations have confirmed the idea, suggested by Sraffa and taken up by Kalecki, that industrial firms operate, at least as a first approximation, in conditions of constant average variable costs if the fixed input is divisible. In the short period, decreasing total average costs are due to a variation in proportions between inputs, permitting a more efficient use of the plant, increasing its degree of utilization and reducing idle periods. Beyond the point of optimal utilization, increases in output bring about a rise in total average costs. However, industrial firms generally design their plants to run at 70–80 per cent of maximum productive capacity, thereby ensuring themselves reserve capacity to handle temporary increases in demand or unexpected plant breakdowns.

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Production processes are often characterized by the presence of 'limitational inputs'. For instance, measuring marginal productivity of labour in a textile firm means varying the quantity of labour while keeping constant other inputs such as yarn, energy, water, machines hours, etc. But if the quantity of yarn is kept constant, no increase in output will be obtained and marginal productivity will appear to be zero. A similar difficulty occurs with team production, because each team member's marginal productivity is impossible to determine. In both these cases, the concepts of marginal productivity and thus marginal costs appear analytically weak and with no practical relevance.

In long-period static analysis, increasing returns are obtained when a larger scale leads to reduced input requirements per unit of product. Increasing returns to scale are linked to the possibility of increasing the quantity of all inputs. This usually allows a reorganization of production as well as changes in the combination of inputs. Decreasing returns to scale occur when there is some restriction that prevents some elements of production from increasing in optimal proportion.

Organizational capacity is often considered as a limit to the expansion of increasing returns. But there are no reasons why this capacity might not in the long period be increased by adopting more efficient control systems and allocating many administrative and organizational tasks to specialist staff. Organizational capacity ought to be considered as a limit on the growth rate of a firm at any moment in time, rather than on size *per se* (Kalecki, 1937, p. 105).

Returns of scale are technical in nature because they are independent of any assumptions about the prices of inputs. The notion of economies of scale is used to refer to a situation where the prices of inputs may vary in relation to the quantities acquired. Economies of scale occur when a larger dimension of scale leads to a lower total average cost. The scale dimension is generally expressed by productive capacity, i.e. the optimal producible quantity in relation to given organizational and institutional conditions.

In spite of methodological differences, numerous empirical studies seem to agree on the presence of significant economies of scale in most of the industries examined (cf. Pratten, 1988). Four groups of factors which combine to produce economies of scale can be identified:

1. Technical factors related to the three-dimensionality of space, heat dissipation and the indivisibility of some production elements.
2. Statistical factors arising from the possibility of reducing all types of stocks or reserves (e.g. raw materials, machine spare parts, working capital) by increasing the overall quantities involved in production.
3. Organizational and administrative factors linked to the growth of coordination capacity as the company expands.

4. Economies by controlling input and output markets (pecuniary economies in buying inputs, advantages in raising capital, more discretion in fixing the output price).

Economies of scale determine a decrease in total average costs to the point of minimum optimum scale (MOS) or minimum efficient scale (MES). If the firm wants to increase its productive capacity further, the number of plants may be multiplied (Kalecki, 1937, p. 105). Beyond this limit, the average cost becomes constant and we are faced, not with a curve, but with a series of discrete corresponding points and different technologies available at any given moment. Moreover, if discontinuities exist in the sizes of available plants, there will be no continuous curve even in that part preceding the limit corresponding to the maximum plant, as it is impossible to move from one plant to another by small increases (Sylos Labini, 1956, ch. 1).

With multi-plant firms, a scale increase in one plant may lead to reductions in unit costs in other plants, due to a better balance of processes which cuts the waste of productive capacity. The need to combine the productive capacities of single machines, plants or single stages of the production process, according to specific relations of complementarity, means that an increase in scale takes place in discrete jumps.

Efficiency is not only linked with size. It also depends on many other factors: capital endowment and the conditions of the financial markets; the characteristics of entrepreneurship; accumulated output over time and the time profile of production processes; technical training; the number of different outputs produced by an individual firm; transaction costs and market characteristics; regulations affecting employment; tax legislation and mechanisms of innovation diffusion. All these factors change from firm to firm and in relation to how its specific institutional environment evolves. Hence the problem of the optimum size of a firm is not unequivocally predetermined, since it 'is not a technical problem like that of the optimum size of a plant. The optimum size of an organization involves comparisons of quality and efficiency, and therefore belongs to the qualitative residual of the analysis of a productive process' (Georgescu-Roegen, 1964, p. 296).

Efficiency is also linked to technical change. There is a close interdependence between technical change and economies of scale, because an increase in dimensions may favour the adoption of new techniques, just as the introduction of new techniques may allow an increase in the scale of production. If a new technique is associated with an increase in the dimension of scale, we have dynamic economies of scale. Dynamic economies of scale are also due to an increase in specialization and to learning processes.

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New technologies may require high investment in fixed capital and often cause the importance of service activities – such as planning, design, organization, marketing, advertising, administration – to increase significantly. This entails a reduction in the share of direct cost (in particular labour cost) in relation to total cost. The introduction of computer-based technology may bring about shorter production processes and a lower cost of production flexibility. The cost reduction in producing differentiated goods in a flexible way with the same equipment is mainly due to decreased set-up times. A shorter set-up time allows the production of a wide range of outputs in small batches without the need for large inventories. Computer-based technology may thus provide the opportunity to enjoy both economies of scale and economies of scope at the same time.

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