Alternative Microeconomic Foundations for Macroeconomics: the controversy over the L-shaped cost curve revisited

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One of the least controversial empirical facts is that observed average cost curves of firms appear to be linear for a wide range of output and do not conform to the expected U-shape form. The first part of this paper reviews the literature which, between the late 1920s and the late 1940s, empirically found the so-called L-shaped cost curve and claimed that this represented a serious challenge to orthodox economics. This literature shows that, by the end of the 1940s, two unrescinded positions stood side by side within the profession. On one hand, it was claimed that the empirical findings of more ‘realistic’ cost curves did not have radical consequences for orthodox theory. On the other hand, it was argued that an alternative microeconomics—that is to say one based on observed functional relationships—could provide better foundations for aggregate analysis. In this paper, this suggestion is pursued and attention is given to the implications of abandoning the two ‘classical’ assumptions—decreasing marginal productivity of labour and perfect substitutability of factors—for the construction of the aggregate supply function. The conclusion is reached that the adoption of linear cost curves improves the analysis of the constraints to the expansion of aggregate demand, and accounts for another important empirical fact in macroeconomics, i.e. the absence of an inverse relationship between wages and unemployment.

1. Introduction

Much recent debate in the literature has focused on the quest for microfoundations in macroeconomics, but there is still no agreement on the appropriate foundations for a theory of the overall behaviour of the economy. On one hand, it seems desirable for aggregate relationships to be rooted in the optimizing behaviour of individuals, while, on the other, aggregate relationships are expected to capture stylized facts and observed behaviour patterns.

A well-known empirical fact is that observed average cost curves of firms appear to be linear for a wide range of output and do not conform to the expected U-shaped form. There is indeed a vast literature that advocates L-shaped cost curves to explain the behaviour of firms, but this assumption has not become part of mainstream economics.
As far as macroeconomics is concerned, the aggregate supply curve does not provide an overall picture of the structure of costs in the economy, but rather the state of expectations in the labour market. This is the result of a process by which the supply side of macroeconomics has become more closely identified with the conditions of the labour market rather than with the structure of production. Thus, there is little room for L-shaped cost curves in a conception of aggregate supply, where it is only conditions in the labour market that seem to matter.

The structure of this paper is as follows. In Sections 2 and 3, I discuss the origin of the L-shaped cost curve in the works of Kahn and Kalecki and show how these authors differ in their use of that particular assumption. In Sections 4 and 5, I review the debate on the assumption of linear cost curves and discuss its implications for the critique of marginal analysis. In Section 6 the aggregate supply curve is drawn under different assumptions about costs and price formation. Finally, the main conclusions of the paper are set out.

2. The Discovery: Kahn

R. F. Kahn is probably the inventor of the L-shaped cost curve. In his study of the effects that a fall in demand had on the behaviour of firms in the 1920s’ depression, he looked at two methods by which production could be reduced in the short run. When there are two types of costs, i.e. quasi-fixed costs (salaries and maintenance costs) and prime costs (wages and raw materials costs), each firm is faced with two alternatives: either (i) it reduces the number of machines employed within a given plant; or (ii) it reduces the number of days during which the machines in a given plant are employed. Two elements are relevant in the firm’s decision: the size of quasi-fixed costs and the characteristics of the machines. In the latter case, there are two possibilities: either (1) the machines are uniform or (2) the machines are not uniform.

Let us suppose that condition (1) holds. We then have a continuously decreasing average cost of daily output per unit, reaching its minimum point at full capacity level. Should condition (2) prevail, then the average cost reaches a minimum at a point to the left of full capacity. In the latter case the cost curve takes the familiar U-shaped form.

Supposing machinery to be uniform, i.e. that constant marginal costs prevail, it is always more profitable to reduce the number of days of production — method (ii) — since working for only a few days a week involves a reduction of quasi-fixed costs. (Assuming, of course, that these costs do not vary according to the length of the interval between one production session and the next.)

Conversely, if the machines are not uniform, i.e. if, after a point, marginal costs rise, then method (ii) is more profitable only at low output levels. It is more profitable as long as the gain deriving from lower weekly quasi-fixed costs (because production is suspended) is offset by the use of less efficient machines when the plant is worked at full capacity.

The most efficient method of reducing costs when demand is particularly low is, then, to work full time some days and suspend production during the other days of the week. Kahn discovered that this was precisely the behaviour of the firms in the cotton and coal industries during the 1920s’ depression in England. The reason is that, with method (ii), the average prime cost — which is given by the ratio between the daily total prime cost and the daily output — does not change as output varies, i.e. as the number of days increases. When the machines are used every day, production cannot be further increased and the average cost becomes infinite. The average (and marginal) cost curve then has the shape of an inverted L.

On the basis of this analysis, Kahn drew the conclusion that the assumption of perfect competition should be abandoned. In fact, the observed behaviour of firms was most rational in the short run, because by working part-time they minimized their costs. It follows that, in the presence of L-shaped average cost curves, the implication of perfect competition — when demand falls, either firms produce at full capacity or they are forced to leave the market — does not hold. Conversely, by assuming imperfect competition, it can be shown why the equilibrium level of output for each firm is below full capacity.

The aggregation problem was partly touched on by Kahn, who most of the time assumed that firms have the same average unit costs, although they may differ in size. So the aggregate supply curve for an industry — obtained as the sum of the individual cost curves of each firm — also has the shape of an inverted L.

However, Kahn claimed that, in normal conditions, ‘the marginal cost curve is rising very steeply’ (Kahn, 1989, p. 87). So the L-shaped average cost curve is presented as the extreme case of the more general assumption of rising marginal costs.

In fact, Kahn did not reintroduce the L-shaped cost curve in his so-called multiplier article, although he reiterated there the claim that ‘at times of intense depression, when nearly all industries have at their disposal a large surplus of unused plant and labour, the supply curve is likely to be very elastic’ (Kahn, 1972, pp. 10–11).¹

One possible explanation of Kahn’s early rejection of the L-shaped cost curve is that it was severely criticized by Pigou in the latter’s otherwise glowing referee report for Kahn’s Fellowship Dissertation. Here is the relevant passage:

The suggestion [is] that we may reasonably suppose the short-period supply curve of a typical firm to be such that, for all quantity of output (above a small initial quantity) average prime cost per unit is substantially the same until a so-called ‘capacity output’ is attained, and no output in excess of this can be secured in a short period at any cost, however high. Now Kahn’s discussion does not, so far as I can see, support this conclusion. Moreover, the conclusion itself is patently out of keeping with the facts. It may well be, indeed, that in many industries there is, for a typical firm, a considerable range of output, in respect of which average prime cost per unit is approximately constant. But it is ridiculous to suppose that there suddenly comes a point at which this cost bounds up to infinity. If by ‘capacity output’ we mean maximum possible output, then it is certain that average prime costs will have risen steeply for...

¹ Still, in 1987, Kahn wrote to R. Morris: ‘I think that the concept of a horizontal short-period supply curve is exaggerated’ (Morris, 1992, p. 1242).
sometime before that output is reached: if we mean optimum output, in the sense of that output at which average prime plus overhead costs are a minimum, it is certain that average prime cost does not rise to infinity immediately that output is exceeded. In several later passages Kahn shows himself quite conscious that his L-shaped supply curves are often not realized in fact, and fortunately the main drift in his argument holds good apart from them. But nevertheless it is I think unfortunate that he should assign to them, as he does, a central place in his formal analysis.\(^2\)

Neither the L-shaped cost curves nor the assumption of imperfect competition was incorporated in the General Theory, although Keynes later acknowledged that it was the assumption of increasing marginal costs that had led him to accept conclusions at variance with the facts. Interestingly enough, Keynes held Kahn responsible for maintaining the 'classical' assumption of rising marginal costs in the short period and, even more interestingly, Kahn accepted the responsibility (Marcuzzo, 1994a, pp. 31–34).

It was, rather, during the years of the so-called 'consensus' in macroeconomics, marked by the acceptance of the IS-LM model, that, by implicit theorizing, the hypothesis of a perfectly elastic aggregate supply curve was made. Thus, changes in aggregate demand were thought to cause changes in real output at constant prices, as if the average cost curves of firms were, in the relevant range, linear.

3. The Generalization: Kalecki

The second discoverer of the L-shaped cost curve was M. Kalecki, who made the assumption of constant marginal cost up to the point of full capacity, the general case in aggregate analysis.\(^3\)

According to J. Osłowski, the assumption of constant marginal cost was already implicit in Kalecki's early work, that is to say he left Poland.\(^4\) However, only from 1938 onwards, when Kalecki had been in England for two years, did he assume it as a general hypothesis in his analysis. Also Chiostu, in his study on the microeconomic foundations of Kalecki's macroeconomic theory, argued that by 1933, with the argument presented in Proba, L-shaped cost curves had already become implicit.\(^5\)

There can be no mistaking the importance of the period spent in Cam-

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\(^2\) King's College Archives RKF Papers, 2/8.

\(^3\) ' [...] conditions of approximately constant returns prevail in the short period, in the economy as a whole' (Kalecki, 1939, p. 21).

\(^4\) Even before Kalecki left Poland in 1935, in numerous discussions at the Institute for the Study of Business Cycles and Prices he had argued that in many firms unit prime cost was in fact fairly constant over a considerable range of output changes. He attempted to test this proportion in his empirical studies on the operation of cartels in Poland. In 1935 Kalecki & Ludała published a paper on fluctuations in prices, costs and individual output in Poland, from 1928 to 1934. The authors pointed out that 'it would be incorrect to perceive any direct link between the direction of cost changes and the direction of changes in output.' (Kalecki, 1990, p. 484).

\(^5\) In support of his contention, Chiostu quotes the following sentence from Proba: 'effective costs (namely costs other than amortization and interest on capital) [...] may be considered to a large extent as proportional to production' (Chiostu, 1989, p. 106).

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\(^6\) Kalecki arrived in England in 1936 and spent the academic year 1936–1937 mostly at the London School of Economics: at the end of 1937 he moved to Cambridge, where he remained until the Summer of 1939 (Kalecki, 1990, p. 507).

\(^7\) See the letter of F. Sraffa to J. Robinson of 28 December, 1938: 'Rothbarth and Kalecki both came to my seminars and add considerably to the interest of the discussions, although they don't talk much at the seminars, not even to the Americans' (Kalecki, 1990, p. 523). E. Rothbarth was taken on in the Cambridge Research Scheme at the same time as Kalecki (see Footnote 8: 'theAmericans' are probably J. Dansley and L. Turbio, of whom more is said in Section 4).

\(^8\) 'The Cambridge Research Scheme of the National Institute of Economic and Social Research into Prime Costs, Proceeds and Output' was set up at the end of 1938 with the purpose of providing Kalecki with a job in Cambridge. The members of the Board were Austin Robinson, Kahn, Kalecki, Chamberonowicz, Sraffa, while Keynes was Chairman. After one year, Kalecki presented the main results of his research in the form of an 'Interim Report', which received very critical comments from J. Robinson and R. Kahn. As a result, Kalecki resigned and left Cambridge.

\(^9\) In his 'Prime costs and proceeds: an interim summary of results', Kalecki explicitly stated that the purpose is to verify 'where diminishing returns were at operation' (Kalecki, 1990, p. 523).
In his 1940 article, which summarized the results of his empirical work with the Cambridge Research Scheme, Kalecki showed how to derive the supply curve for an industry that is not supposed to operate under competitive conditions. The relevant hypothesis is that 'in general, marginal cost curves of a great majority of firms are not steeply upwards sloping over the relevant range of output [...] and [...] marginal cost curves may be assumed horizontal' (Kalecki, 1940, p. 97).

In constructing the industry supply curve, Kalecki assumed first that prices are formed by equating marginal cost to marginal revenue. Market imperfection is then defined as a function that relates the elasticity of demand for the product of each industry to the ratio between the price charged by the individual firm and the average price of the industry (an average of the prices charged by each firm, weighted according to their respective outputs). The degree of market imperfection is constant if, for each individual firm, the elasticity of demand is correlated solely with its price; otherwise the degree of market imperfection varies with the average elasticity of market demand. When all firms are assumed to be identical and constant marginal costs prevail, then the industry supply curve is perfectly elastic and its position is determined, for a given state of market imperfection, by the level of the average cost. If we abandon the assumption that all firms in the industry have identical cost curves, but retain the assumption that average costs are linear, we again obtain an industry supply curve that shifts upward or downwards directly with changes in the average elasticity (in absolute value) of market demand.

In the final part of the paper, Kalecki drops the assumption that firms fix prices according to the equality of marginal cost and marginal revenue and examines the case of oligopoly. This case arises when the firm sets the price at a point where marginal revenue is greater than marginal cost. The price is set at this particular level because each firm knows that a lower price would induce the rival firms to lower their prices, while a higher price would not make them raise it. Thus, in any given market, the degree of oligopoly is measured by the ratio of marginal revenue to marginal cost, which is, in general, greater than one. The behaviour of the degree of oligopoly is reflected in the slope and in the position of the supply curve of the industry.10

Kalecki was highly original in producing a methodology to study the aggregate effects of price policies by firms under different assumptions about the degree of market imperfection. Although at the cost of simplification, he was able to show that it is worth abandoning the traditional apparatus to obtain results that appear to be more in accordance with empirical observation. For instance, it is thus possible to explain why there need not be an inverse relationship between real wages and unemployment. Perhaps it is not a far-fetched inference that this was one of the reasons why he was criticized by people like Kahn and Keynes, who were never fully persuaded by the 'unorthodox' microfoundations of Kalecki's macroeconomics.

4. The Evidence

As we know, Kalecki's results found support in the empirical work done by two Cambridge Research Students—John Dunlop and Lawrence Tarsis—who analysed the behaviour of real wages in Great Britain and in the United States with a view to testing the proposition set out by Keynes in the General Theory, according to which real wages were expected to vary in the opposite direction to money wages.

On the contrary, the evidence collected by Dunlop showed that real and money wages vary in the same direction. The converse conclusion, which Keynes had reached, was dependent on the traditional assumption of rising marginal cost. In Dunlop's opinion: 'The extent to which cost curves are rising, except at the very peak of the boom, has probably been over-emphasized in view of the presence of excess capacity in many industries' (Dunlop, 1938, p. 432).

The point was also supported by a study of several industries, presented in a following article, which showed that '[the marginal cost curve] is virtually horizontal in most industries for most ranges of actual outputs' (Dunlop, 1939, p. 529).

Likewise, in his study of the relationship between real and money wages in the US, Tarsis reached the same conclusion as Dunlop: 'because marginal cost curves were not inclined positively, that we get a positive association when we should expect, on Mr. Keynes' assumptions, the association to be inverse and negative' (Tarsis, 1939, pp. 153-154).

As we know, these findings led Keynes to admit the possibility that constant marginal costs may be an important factor in explaining the positive correlation between real and money wages (Kaysen, 1939, p. 407). Nevertheless, he remained throughout sceptical of Kalecki's procedure to explain the constancy of the wage share.

In the meanwhile, outside Cambridge, several studies of the actual behaviour followed by firms in setting prices seemed to confirm the existence of linear costs. The most famous study was undertaken by the Oxford Research Group and its results were presented by Hall & Hitch (1939).

Similar results were reached independently by J. Dean and R. Whitman, who presented them at the 'Round Table on Cost Functions' at the Meeting of the American Economic Association in 1939. In the resumé published in the volume of Proceedings (March 1940), Dean's work was summarized as follows: '[... ] six studies of short-run cost were summarized [... ] Theoretical analysis usually posits rising marginal cost over the relevant output range, yet no instance of rising marginal cost within the range of actual operation was found [... ]'.

Similarly, Whitman's results were that: 'the total store variable cost function

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10 With further simplifying assumptions, Kalecki was able to show that the supply curve obtained could, under particular circumstances, also be employed to explain the stability of the wage share. In other words, the relative share of wages would be constant if the upward shift of this curve during the slump is sufficiently important to have an influence upon the relative share of manual labour in the net output of the same order as that exerted jointly by the upward slope of the same curve and the change of "basic" raw material prices relative to wage cost' (Kalecki, 1940, p. 110). The point is that, in this case, the result can be obtained without the 'rather stringent assumption', made in the 1938 article, of a perfectly elastic supply curve.

11 However, Dunlop's handling of statistical material was severely criticized by Ruggles (1940).
cost is not determinate at that point. Since marginal cost is the rate at which total cost changes for indefinitely small changes of output in either direction, in order for the marginal cost to be determinate, the slope of the total cost function must be the same for indefinitely small changes of output in either direction: otherwise, there is a discontinuity in the total cost function at a particular level of output and the corresponding marginal value is not determined.

However, the existence of a discontinuity does not impair the validity of the marginal principle as a tool to determine the point of maximum profit. In fact, the required condition is weaker than the strict equality between marginal cost and marginal revenue. All that is needed is to find a point where marginal revenue is greater than marginal cost, at immediately lower levels of output, and where marginal revenue is smaller than marginal cost, at immediately higher levels of output. Thus, Bishop concluded:

These inequalities, which are necessary anyway as an assurance that we have a profit maximum are the heart of the matter: and when the two inequalities hold, we know that we have at least a local profit maximum, regardless of the possible indeterminacy of the marginal quantities at the output in question. (Bishop, 1948, p. 611)

The same point, although less precisely expressed, was made by Machlup (1946), who also claimed that the foundation of the marginal principle lies in the acceptance of profit maximization as guidance for entrepreneurial action and not in the particular formulation as equality between marginal cost and marginal revenue. The latter is only valid under particular circumstances, when both curves are continuous.

To conclude this cursory review of the debate on the empirical evidence on the L-shaped cost curve, it is interesting to note that Kahn, too, reacted strongly against Andrews' attempt to build an alternative theory of price on the basis of 'what businessmen say'. He wrote:

The conflict between what businessmen say and prevalent academic doctrine on price and output policy arises partly from the habit of expressing this doctrine in terms of tendency for marginal revenue to be equated to marginal cost. Such phrases mean nothing to the business man. But the essence of this doctrine does not lie in the use of marginal concepts. It could be equally well, if less elegantly, expressed in terms of each individual firm maximizing its profits. Put in that more homely form, the concept does readily lend itself to the operation of the forces of trial and error, and to the display of flair—the success of which by no means depends upon the manner in which it is rationalized. (Kahn, 1952, p. 126)

Thus, the debate, which went on until the early 1950s, ended in an ambiguous position. On one hand, it was argued that the introduction of more 'realistic' assumptions about the shape of cost curves did not require fundamental changes in orthodox analysis, which could therefore continue to be expressed in the traditional form. On the other hand, in the IS-LM model it was implicitly assumed that the aggregate supply curve was perfectly elastic, as if the cost curve were linear up to the point of full capacity.

17 The framework for this approach had already been provided by J. Robinson's, The Economics of Imperfect Competition (see Marcuzzo, 1949). A good example of this attitude is Noyes (1941), who defended the need for imperfect competition without discarding the assumption of increasing marginal costs.

18 For instance Staehe (1947, p. 329) claimed that most empirical work showed a 'statistical bias towards linearity'. The same point was also made by Ruggles (1941).
6. The Aggregate Supply Curve

If we look at the history of macroeconomics after the end of the consensus on the so-called neoclassical synthesis (IS-LM model), we can see that the analysis based on the aggregate supply curve changed direction. In order to prove this assertion, let us examine the construction of the aggregate supply curve more closely.

The aggregate supply curve is a relationship between the price level and the level of income, which is derived from three fundamental relationships: (i) the production function; (ii) the price function; (iii) the function that links money wages to employment.

Let us suppose we initially have perfectly competitive conditions, a production function and a demand for labour (E⁰) that exhibit the usual properties. Then:

\[ Y = f(E), \quad f'(E) > 0, \quad f''(E) < 0 \]  
\[ f'(E) = W/P \]  
\[ E^0 = E^0(W/P) \]  
\[ W = \bar{W} \]

where \( E \) = employment; \( W/P \) = real wage, \( Y \) = output; \( W \) = money wage exogenously given.

In this simplified world, the aggregate supply curve is given by:

\[ Y = b(P, \bar{W}) \]  
with \( b > 0 \). Equation (5) presents a positive relationship between \( P \) and \( Y \). The crucial assumption is the decreasing marginal productivity of labour, according to which production can be augmented only if the real wage decreases and, therefore, for a given money wage, only if prices increase.

Let us now drop the assumption that the money wage is fixed and assume instead that the following holds:

\[ W = W_{-1} \left[ 1 + \varepsilon \left( \frac{E - E^*}{E^*} \right) \right] \]

where \( W_{-1} \) is the money wage of the previous period and \( \varepsilon \) is the elasticity of money wages with respect to the unemployment rate. The latter is measured, in percentage, as the difference between the actual employment level (\( E \)) and the level of employment at which there is equilibrium in the labour market (\( E^* \)).

We can now specify three alternatives on price formation mechanisms.

The first is represented by Equation (2), i.e. profit maximization under conditions of perfect competition and decreasing marginal productivity of labour:

\[ P = W/f'(E) \]  

Alternatively, we can drop the assumption of perfect competition and retain assumptions of increasing marginal costs and profit maximization that is, of variable mark up:

\[ P = \frac{1}{\frac{1}{\eta(P)} - \frac{1}{\eta(P)}} \frac{W}{f'(E)} \]  
where \( \eta = \) elasticity of demand in absolute value.

Finally, if we give up the assumption of both increasing marginal costs and profit maximization (that is if we assume a constant mark-up) we have:

\[ P = (1 + m) \frac{W}{k} \]

where \( m = \) mark-up; \( k = \) average productivity of labour.

Now we can substitute (6) in (2), (2a), (2b):

\[ P = W_{-1} \left[ 1 + \varepsilon \left( \frac{E - E^*}{E^*} \right) \right] \left[ 1 + \frac{1}{\frac{1}{\eta(P)} - \frac{1}{\eta(P)}} \right] \]

where

\[ P = W_{-1} \left[ 1 + \varepsilon \left( \frac{E - E^*}{E^*} \right) \right] \left[ 1 + \frac{1}{\frac{1}{\eta(P)} - \frac{1}{\eta(P)}} \right] \]

The simplest case is given by (7b), i.e. when both the mark-up and the marginal productivity of labour are constant. In the latter case, given that:

\[ P_{-1} = \frac{1 + m}{k} W_{-1} \]
we have

\[ P = P_{-1} \left[ 1 + \varepsilon \left( \frac{E - E^*}{E^*} \right) \right] \]

Given the assumption of constant average cost, that is, where:

\[ Y = kE \]

\[ \text{These are the hypotheses on which the aggregate supply curve is based in Dornbusch & Fisher (1990). However, the constancy of the marginal productivity of labour is justified without discarding the neoclassical production function, but by simply postulating that the degree of capital utilization is procyclical.} \]
we can transform (9) into a relationship between $P$ and $Y$:

$$P = P_{-1} \left[ 1 + e \left( \frac{Y - Y^*}{k} \right) \right]$$

(11)

which becomes:

$$P = P_{-1} \left[ 1 + e \left( \frac{Y - Y^*}{Y^*} \right) \right]$$

and setting $h = eY^*$, we have:

$$P = P_{-1} [1 + h(Y - Y^*)]$$

(12)

which is the aggregate supply curve. With constant marginal costs and constant mark-up, prices do not change if and only if $Y = Y^*$.

The case of increasing marginal costs and variable mark-up can be considered as identical to the previous one, as long as the mark-up is assumed to vary in such a way as to offset exactly the decreasing marginal productivity of labour.

In the more general case, i.e. when increasing marginal costs are assumed to prevail, the derivation of the aggregate supply curve is more complex, because employment is no longer proportional to output. Moreover, if we leave the world of perfect competition, the elasticity of demand must be taken as variable.

In perfect competition, the aggregate supply curve can be written as:

$$P = \left\{ \frac{W_{-1}}{f' (E)} \right\} \left[ 1 + e \left( \frac{E - E^*}{E^*} \right) \right].$$

(13)

Setting $E = f^{-1} (Y) = g(Y)$, we obtain:

$$P = \left\{ \frac{f'(E_{-1})}{f'(E)} \right\} \left[ 1 + e \left( \frac{g(Y) - g(Y^*)}{g(Y^*)} \right) \right].$$

(14)

In imperfect competition, given, as we saw in Equation (2a), that:

$$P = \left\{ \frac{1}{1 - \frac{1}{\eta(P)}} \right\} \frac{W}{f'(E)}$$

and substituting for $W$ in Equation (6), we obtain:

$$P = \left\{ \frac{1}{1 - \frac{1}{\eta(P)}} \right\} \frac{W_{-1}}{f'(E)} \left[ 1 + e \left( \frac{E - E^*}{E^*} \right) \right].$$

(15)

In the previous period, (2a) takes the form:

$$P_{-1} = \left\{ \frac{1}{1 - \frac{1}{\eta(P)}} \right\} \frac{W_{-1}}{f'(E_{-1})}$$

from which, substituting into (15), we obtain:

$$P = \left\{ \frac{f'(E_{-1})}{f'(E)} \right\} \frac{1}{1 - \frac{1}{\eta(P)}} \left[ 1 + e \left( \frac{g(Y) - g(Y^*)}{g(Y^*)} \right) \right].$$

(16)

Thus, the absence of simpler assumptions—such as the constancy of the marginal productivity of labour and of the mark-up—does not change (for $Y > Y^*$) the sign of the static aggregate supply function, but only influences the value of its elasticity with respect to output.

Any increase in prices, associated with changes in income and employment, in the static case, is then mainly accounted for by changes in money wages, due to a change in the conditions in the labour market. Variations in money wages are then transferred more or less proportionately—according to the assumptions made on the behaviour of labour productivity and mark-up—onto prices. It is thus apparent that the aggregate supply curve is nothing more than a travesty of that empirical regularity known as the Phillips curve (Rao, 1991).

The need to give a microeconomic foundation to what appeared only as an empirical regularity motivated the introduction of price expectations into the wage equation. The original form of the Phillips curve was then transformed accordingly. Let $\pi$ be the inflation rate and $\pi^e$ the expected rate, then:

$$\frac{W}{W} = \pi^e + h(Y - Y^*).$$

(17)

Now, Equation (17) explains the dynamics of the money wages not only on the basis of conditions in the labour market, but also on the workers' expectations for the real wage.

Taking the simplest case, i.e. when prices vary exactly in proportion to the variations of money wages, i.e. $W/W = \pi$, we can write the dynamic aggregate supply curve as

$$\pi = \pi^e + h(Y - Y^*).$$

(18)
Income can be different from $Y^*$ only when $\pi \neq \pi^*$, i.e., when expectations are not fulfilled. This is the case of adaptive expectations, which can be written, for instance, as:

$$\pi_t = \pi_{t-1}. \quad (12)$$

Equation (18) can also be employed to show that for $Y = Y^*$, we have $\pi = \pi^*$, that is, expectations are fulfilled. This is the reason why, in the long run, the aggregate supply curve is vertical and the inflation rate is constant and equal to the expected rate. The same result is obtained in the static case where, for $Y = Y^*$, the price level is the same as in the previous period.

Summing up, the short run aggregate supply curve is constructed as positively sloped because of the particular assumptions made about the labour market. Thus, the possibility of increasing output and employment in the short run, although at rising prices (or at accelerating inflation), is made dependent on the conditions prevailing in the labour market. In general, it depends on whether the workers' expected real wage is greater than the actual real wage, i.e., the wage that prevails, for a given money wage, after firms have set prices.

7. Conclusions

We have thus seen that, in standard macroeconomics, the aggregate supply curve does not give a picture of the structure of production in the economic system, but mainly of the conditions prevailing in the labour market. This is a serious fault in macroeconomics since, among other things, different representations of cost conditions have different policy implications.

The traditional cost curves (U-shaped average cost) convey the idea that, in the aggregate, production can always be augmented although at rising costs. As long as workers are prepared to accept a reduction in real wages, 'it is always possible, at least in theory, to have full employment of the total supply of labour' (Ackley, 1961).

Conversely, if cost curves are assumed to be constant up to the point of full capacity or discontinuous, then it is apparent that the constraint on production is not the real wage, but insufficient productive capacity. Moreover, if firms are, most of the time, on the horizontal segment of their average cost curve, then macroeconomic analysis should be concerned, as in Kalecki's analysis, with the aggregate effect of different price policies by firms. It is on this basis that we should endeavour to predict the effects of changes in aggregate demand on prices and output.

When firms reach the limit of their productive capacity, i.e., when they are on the vertical segment of their L-shaped cost curve, it simply means that there are bottlenecks in the productive system, and not that we have reached the 'natural' or equilibrium rate of unemployment.

Of course, it remains legitimate to ask, as Pigou did, whether the assumption of a cost curve that presents a 90° angle is a sensible one or whether it is

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17 We need not assume such an oversimplified version of the adaptive expectations hypothesis. We could, for instance, also include a correction term; for instance: $\pi_t = \pi_{t-1} + \gamma(\pi_{t-1} - \pi^*_{t-1})$, with $0 < \gamma < 1$, see Carlin & Soskice (1990, p. 110).

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more reasonable to assume that costs start to rise gradually and not suddenly at an ill-defined level of full capacity.

A fair answer is that the point with the L-shaped cost curves is not to determine the exact level of output at which firms start raising prices, but to have a clearer picture of the underlying forces determining prices in the aggregate.

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References

Ehrman, W. L. (1947) 'Factors determining the location of the least cost point', American Economic Review, 37, pp. 910-918.

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18 Full capacity is a concept which, by its very nature, is hard to define precisely. In the debate on the L-shaped cost curve it was correctly argued that discontinuities and indivisibilities in the production process are the very reason why one should be wary about a cost curve with a 90° angle (see Haines, 1948).
Ruggles, R. (1940) The relative movements of real and money wages, Quarterly Journal of Economics, 55, pp. 130-149.
Erratum

A careful reader of my ‘Alternative Microeconomic Foundations for Macroeconomics’ (Review of Political Economy, 8, 1996, pp. 7–22) has detected a slip on p. 17 and p. 18 of my article where I say that I am assuming constant marginal and average costs. However, Equation (10) and footnote 15 show clearly that what characterizes my third case is constant marginal and average productivity. I am grateful to my reader for pointing this out and to the editors for the opportunity to correct it.

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