Kahn on the economics of the short period

T. J. O'Shaughnessy*

Introduction

Richard Kahn's first contribution to economics was his Fellowship Dissertation entitled 'The Economics of the Short Period'. When he re-read the dissertation in 1983 for the first time in over fifty years, Kahn says he was 'impressed by it as a contribution made at the time—only two and half years after I had embarked on the study of economics' (Kahn, 1989, p. xxii, emphasis in original). A reader today would readily agree. The problem Kahn set himself—the development of the Marshallian concept of the short period—proved to be important in two revolutions in economics in the 1930s: the first involving the economics of imperfect competition and the second involving the Keynesian principle of effective demand. This article examines the use Kahn made of Marshall's short period in the dissertation and afterwards, and discusses the role of short-period analysis in Keynesian economics.

The empirical background

A feature of Kahn's dissertation is how it combines empirical investigation and theoretical innovation in a way that is all too rare in economics. In the course of preparing the dissertation, Kahn studied material about the UK cotton industry. The industry, concentrated in Lancashire, had been in difficulties throughout the 1920s. It had lost a third of its pre-War market and was burdened with chronic excess capacity. The problem of excess capacity was particularly serious in the sector of the industry which used American cotton to produce coarser yarns; here most mills were working only half-time. Kahn became interested in cotton through Keynes who had been involved in attempts to restructure the industry during 1926–9. (See Keynes 1971–89, Vol. XIX [cited as J.M.K. XIX], Part II, pp. 578–637; Moggridge, 1992, pp. 449–52.) Keynes had argued that responding to lower demand by having all firms work short-time was disastrous; what was necessary was a policy of rationalisation under which the weaker firms and less efficient plants could be closed down. Short-time working increased the burden of overhead costs, including interest costs. Many firms were committed to high interest charges following the short-lived boom in 1919–20, when nearly half the capacity of the industry changed hands at inflated prices. The problem of overhead costs was central to the policy debate Keynes was involved in; it was also to be central to the analysis in Kahn's dissertation.

Manuscript received 6 June 1992; final version received 12 August 1993.

*University of Oxford.

0309-166X/94/010041+14 $08.00/0 © 1994 Academic Press Limited
One practical—if short-lived—outcome of Keynes’s involvement in the industry was the formation of the Cotton Yarn Association in February 1927. Although the Association controlled about 75% of capacity in the American section of the industry, it made little progress towards rationalisation. It did attempt to restrict output and raise prices, but firms outside the Association simply undercut those inside, so that even this policy had to be abandoned. It was not until October 1928, when the Bank of England—worried about the banking sector’s exposure to the industry—became involved in a policy of encouraging mergers, that industrial reorganisation began to take place.

The theoretical background

Another result of Keynes’s involvement with the Cotton Yarn Association was that he was able to pass some of the data it had collected to Kahn and to put him in touch with those who worked in the industry. The information Kahn collected raised a number of questions about the received Marshallian approach to economic analysis. Most striking was the fact that excess capacity continued to exist in the industry for several years, even though demand showed no signs of reviving. Kahn accepted Marshall’s distinction between short-period and long-period analysis, defining the short period as ‘one in which the fixed plant and organisation of all, or nearly all, the firms can be assumed to remain constant’ (Kahn, 1989, p. 1). However, Kahn argued that Marshall’s notion of the adjustment of capacity to demand in the long period required modification if the required adjustment was in a downwards direction. References in Marshall’s Principles to the short period are not very numerous, Kahn points out, because Marshall’s main concern was the long-period theory of value. This emphasis may be justified in a rapidly growing economy, but not otherwise. Short-period analysis—in which capacity is given and is not necessarily appropriate to the level of demand—comes into its own in such situations.

So long as an inadequate return is being earned on its fixed capital by the preponderating portion of the industry, it is the rate of decay that sets the bounds to the short period; and the short period may run into decades . . . On the other hand, if the industry is a prosperous and a growing one . . . considerations that are based on the short period are only applicable over a short space of time. This space of time may not, in some cases, extend over more than a year, or even less. As Mr Robertson has been heard to put it, ‘the short period is not the same at both ends—and never has been’. (Kahn, 1989, p. 2)

The situation in the cotton industry also brought into question the specification of short-period equilibrium in Marshall. The widespread existence of short-time working was impossible to explain on the assumption that firms were operating in a perfectly competitive market. On the basis of this assumption, what should have been observed was a situation in which the most efficient firms operated at full capacity—defined as the point at which each firm’s marginal prime cost curve cuts the perfectly elastic demand

1 Marshall actually distinguished four ‘periods’, in each of which ‘price is governed by the relations between demand and supply . . . as regards market prices, Supply is taken to mean the stock of the commodity in question which is on hand, or at all events “in sight”. As regards normal prices, when the term Normal is taken to relate to short periods of a few months or a year, Supply means broadly what can be produced for the price in question with the existing stock of plant, personal and impersonal, in the given time. As regards normal prices, when the term Normal is to refer to long periods of several years, Supply means what can be produced by plant, which itself can be remuneratively produced and applied within the given time; while lastly, there are very gradual or Secular movements of normal price, caused by the gradual growth of knowledge, of population and of capital, and the changing conditions of demand and supply from one generation to another’ (Marshall, 1905, p. 216; Marshall’s emphasis).
curve the firm faces—while less efficient firms shut down. Having all firms producing at, say, 50% capacity made no sense.

Kahn’s solution to this problem was to abandon the assumption of perfect competition. In doing so, he draws on arguments put forward three years earlier by Sraffa (Sraffa, 1926). However, as Kahn points out, Sraffa had been mainly concerned with the long period and the problem of increasing returns, but ‘his methods are of even greater significance in the case of the short period’ (Kahn, 1989, p. 85). Kahn identifies two possible causes of market imperfection: ‘preference imperfection’ and ‘transport imperfection’. The first occurs when buyers are not indifferent between the products of different firms; the second when buyers further away from a firm have to pay greater transport costs. In an imperfect market, profit-maximising firms would no longer operate at the point where price and marginal prime cost are equal; instead it is ‘the product of output and difference between price and marginal prime cost’ which is maximised (Kahn, 1989, p. 86). Although Kahn does not use the concept of marginal revenue, his equation determining the profit-maximising position of the firm is closely related to the ‘marginal revenue equals marginal cost’ condition. Kahn writes

\[ p - r = q \]  
\[ \text{(1)} \]

where \( p \) is price, \( r \) is average prime cost (Kahn assumes a reverse-L shaped average prime cost curve), \( f \) is the ratio of output to capacity output and \( q \) is the gradient of the demand curve facing the firm if capacity output were the unit of output. (Kahn calls \( q \) the ‘annihilation coefficient’ since—for a linear demand curve—it is ‘the increase in price that would be necessary to reduce a firm’s output by an amount equal to its capacity output’.) Writing \( x \) for output, the equation of the (linear) demand curve may be written

\[ p = a - qx/u \]  
\[ \text{(2)} \]

with the firm’s revenue being

\[ ax - qx^2/u \]  
\[ \text{(3)} \]

Thus the ‘marginal cost = marginal revenue’ condition becomes

\[ r = a - 2qx/u \]  
\[ \text{(4)} \]

Subtracting equation (4) from equation (2) yields Kahn’s equation [equation (1) above].

\[ p - r = qx/u = f \]  
\[ \text{(5)} \]

Kahn proceeds to show that, if \( q \) is less than \( p - r \), the firm produces at its capacity output, but if \( q \) is greater than \( p - r \), producing at less than full capacity is optimal. ‘Imperfection of the market is now playing the role for which it was cast. It provides an

---

1 A third cause may also be important, although this is not discussed by Kahn. If potential customers do not know the prices charged by different firms or the precise characteristics of the commodities sold by them, they will have to engage in search behaviour before buying. If search is costly, rational customers will continue searching only so long as the potential benefit from visiting one more firm is greater than the cost. High search costs will reduce the extent of such search behaviour and allow high-cost firms to survive. In effect, such firms will specialise in selling to customers with high search costs or customers who happen to have visited only other high-cost firms earlier in their search. Non-zero search costs mean that firms with a range of efficiencies can co-exist in the same market, even though some highly efficient firms have spare capacity. Thus search costs have important implications for how output is distributed across firms of different efficiencies and how changes in demand are met by changes in output across an industry. Kahn grappled with the analogous problem of the distribution of output across firms within an industry in Chapter 9 of his dissertation.
The firm and the industry

The fact that Kahn found evidence of market imperfection in what could have been taken as the paradigm of a competitive industry should have led to doubts about the usefulness of perfect competition as a benchmark case in short-period analysis. Nevertheless, as is well known, when Keynes came to employ Marshall's short period in the General Theory, he chose to assume perfect competition in the goods market. One difficulty that arises when the assumption of perfect competition is relaxed had already been confronted by Kahn in his dissertation and was to be examined further in his article on 'The Problem of Duopoly' (Kahn, 1937). The problem is, how is it possible to aggregate the behaviour of individual firms in order to analyse an industry or a whole economy? In moving from the level of the firm to that of the industry, it is necessary to make some assumption about how other firms will react to, say, a change in price or output by a given firm. In Chapter 7 of his dissertation, Kahn considers one such assumption: that made by Sraffa. Sraffa (1926, p. 547) had argued that, for an industry consisting of similar firms between which competition was imperfect, equilibrium would be the same as if the whole industry were controlled by a single monopolist. Kahn pointed out that this was implausible; for one thing, it implied that a slight degree of imperfection in a market would cause price and output to jump from their competitive to their monopoly values. Kahn went on to consider alternative assumptions underlying the individual firm's demand curve. He criticised the Cournot (1838) assumption that each firm conjectures that other firms will keep their outputs constant if the first firm changes its output. He also criticised what he called the Bertrand-Edgeworth case in which each firm conjectures that other firms will keep their prices rather than their outputs constant, preferring a 'third case' consisting of 'all the complex possibilities that emerge when the business man realises that neither the outputs nor the prices of his competitors will remain constant if he alters his own price' (p. 100). In the dissertation, this third case seemed to involve what later became known as the 'kinked demand curve' (see Hall and Hitch, 1939):

1. Maneschi (1988, pp. 164-6) draws three diagrams based on (Kahn, 1989, Fig. 8.1, p. 121) showing the various possibilities whereby a firm with a reverse-L cost curve will produce at below capacity or at full capacity, depending on the value of Kahn's 'annihilation coefficient'. Maneschi draws in the marginal revenue curve (naturally not drawn by Kahn) corresponding to these cases, showing that what matters is whether this curve cuts the horizontal or vertical portions of the cost curve.

2. Keynes wrote that he took 'the degree of competition' as given; see J.M.K. VII, p. 245. Reddaway (1985, p. 96) points out that this is not the same as assuming perfect competition and criticizes commentators who have attributed such as assumption to Keynes. However, as Tarshis (1979, p. 365) argues, the General Theory has entrepreneurs equating 'marginal prime cost' and 'anticipated price' in choosing the level of employment they offer—that is, they act just as perfect competitors are supposed to; see J.M.K. VII, pp. 426-7. Tarshis goes on to note that while Keynes, in writing The General Theory, confined himself to the case of perfect competition, there was no need for him to have done so, given the developments in the theory of imperfect competition then taking place. Morris (1992) in his review of Kahn (1989), concludes that it remains a 'mystery' why Keynes chose not to incorporate Kahn's work on imperfect competition into The General Theory. In the process, he accuses both Keynes and Kahn of 'fuzziness' about the issue. However, as this section makes clear, there were major obstacles in the way of using imperfect competition in an analysis that involved a high degree of aggregation. In particular, the problem of allocating a given amount of output over heterogeneous firms remains unsolved, except in a number of very special cases. These difficulties are not nearly so serious in the perfectly competitive case since the market may be thought of as ensuring that output is allocated to the most efficient firms (and the most efficient plant within any firm) first.
Economics of the short period 45

[A] single firm may well be aware that if it were to lower its price in an attempt to increase its output, each of the other firms would be forced in self-defence to lower its price by an equal amount; so that it would actually be worse off than it is now. For this reason the price may be prevented from moving downwards. If, on the other hand, a single firm decides to raise its price, its output will drop to zero . . . There is no reason, therefore, why the price should move upwards. But if the price can move neither downwards nor upwards, it must remain where it is. The equilibrium price is any and every price; and the price is where it is for no other reason than that it happens to be so. (p. 103)

However, Kahn needed to determine the shape of the ‘individual demand curve’

\[ y = f(x) \]  \hspace{1cm} (6)

(where, in his notation, \( x \) is a single firm’s output and \( y \) is price) in relation to the ‘industry demand curve’

\[ y = F(X) \]  \hspace{1cm} (7)

(where \( X \) is the industry’s output [\( = nx \) in the case of \( n \) identical firms]). Kahn showed that the equilibrium price would be below the monopoly price—ruling out Sraffa’s conjecture—if

\[ n(-F'(X)) > (-f'(x)) \]  \hspace{1cm} (8)

This could be proved for the Cournot and Bertrand cases but, in order to do so for his ‘third case’, Kahn was forced to consider an argument based on the ‘extreme assumption’ that all firms other than the one under consideration act in cooperation. This gave him an upper bound to the expression on the right-hand side of the above inequality and showed that it held.

Kahn returned to this problem in his 1937 article on duopoly. There he retains the emphasis on the ‘mental processes’ of those who control firms in determining equilibrium in oligopolistic (or, in the simplest case, duopolistic) markets but he places more stress on the search for a determinate solution.

Instead of attributing to each firm more or less crazy assumptions about the nature of its competitor’s behaviour, it is tempting to postulate that the assumptions which it makes are correct, being based either on supreme intelligence or on the employment of the method of trial and error. In this way we shall arrive at the unique position of duopoly, the deviation of any other position from this unique position being a measure of the stupidity of the assumption about his competitor’s behaviour with which, rightly or wrongly, the business man is credited. (Kahn, 1937, p. 2; Kahn’s emphasis)

Kahn calls the equilibrium that results when the Bertrand conjecture happens to be correct ‘Bertrandese’ and defines a ‘Cournotese’ equilibrium in an analogous way. Between these two ‘extremes’ there is a complete range of positions of duopoly equilibrium . . . but every position is a unique position in the sense that it is derived on the assumption of rational beliefs’ (Kahn, 1937, p. 6). Although the kinked demand curve makes a reappearance (p. 9), Kahn argues that this notion requires some co-operation between firms—what he calls the ‘first degree of collusion’—and that the theory of duopoly must proceed without assuming this, especially when attention shifts from perfect to imperfect markets.¹ What Kahn offers instead is a solution concept based on the assumption that the two firms act asymmetrically. One firm, say Firm 2, always attempts slightly to undercut the other firm, which we may call Firm 1. It does not pay

¹ This is the approach of modern non-cooperative game theory. Kahn was aware that this non-cooperative approach would produce outcomes approximating cooperative solutions in the case of repeated games.
Firm 2, however, to produce more than the output at which its marginal cost equals the price. Firm 1 is left with the rest of the aggregate demand at this price. Thus Kahn calls Firm 1 the ‘price leader’ and Firm 2 the ‘price follower’ and goes on to assume that Firm 1 will act to maximise its profits according to ‘ordinary monopoly principles’. This analysis yields an equilibrium position corresponding to the ‘Bertrandesque’ behaviour attributed to the two firms.

Thus suppose the two firms have the same cost function

\[ C_j = cX_j^2, \quad j = 1, 2 \]  
(9)

where the \(X\)'s are the outputs of the two firms and \(c\) is a constant, and the industry's demand curve is

\[ p = a - b(X_1 + X_2) \]  
(10)

for suitable constants \(a\) and \(b\). Kahn assumes Firm 2 will produce at the point where its marginal cost equals price, taking the output of the first firm as given:

\[ 2cX_2 = p = a - bX_1 - bX_2 \]  
(11)

Thus

\[ X_2 = \frac{a - bX_1}{2c + b} \]  
(12)

Firm 1's problem to maximise

\[ \Pi_1 = X_1 \left( a - b \left( \frac{X_1 + a - bX_1}{2c + b} \right) \right) - cX_1^2. \]  
(13)

Setting

\[ \frac{d\Pi_1}{dX_1} = 0 = a - 2bX_1 - \frac{ab}{2c + b} + \frac{2b^2X_1}{2c + b} - 2cX_1 \]  
(14)

yields

\[ X_1 = \frac{a}{3b + 2c} \]  
(15)

while substitution of (15) in (12) yields

\[ X_2 = \frac{2a(b+c)}{(3b+2c)(b+2c)}. \]  
(16)

From these expressions it is possible to calculate the equilibrium price and the corresponding values of the profits of the two firms. One feature of Kahn’s equilibrium concept is that, for identical firms, the price follower earns a higher profit than the price leader; as Kahn put it, both firms would be better off as follower rather than leader (Kahn, 1937, p. 15). This can be demonstrated by evaluating

\[ \Pi_2 - \Pi_1 = pX_2 - cX_2^2 - (pX_1 - cX_1^2) \]

\[ = \frac{a^2b^2c}{(3b+2c)^2(b+2c)^2}. \]  
(17)

which must always be positive.
Kahn's equilibrium concept may be compared with other solutions to the duopoly problem. The Bertrand solution has both firms setting price equal to marginal cost so that

\[ a - b(X_1 + X_2) = 2cX_1 = 2cX_2 \]  
(18)

and

\[ X_1 = X_2 = \frac{a}{2(b+c)}. \]  
(19)

The Cournot solution has each firm maximising its profits while conjecturing that the other firm's output is given. Thus Firm 1 maximises

\[ \Pi_1 = X_1(a - b(X_1 + X_2)) - cX_1^2. \]  
(20)

This leads to the reaction function

\[ X_1 = \frac{a - b\bar{X}_2}{2(b+c)}. \]  
(21)

A similar expression may be obtained for output of the second firm. Setting

\[ X_1 = \bar{X}_1, \quad X_2 = \bar{X}_2 \]  
(22)

yields

\[ X_1 = X_2 = \frac{a}{3b + 2c}. \]  
(23)

The case of collusion has the two firms jointly maximising

\[ \Pi = \Pi_1 + \Pi_2 = X(a - bX) - c\left(\frac{X}{2}\right)^2 - c\left(\frac{X}{2}\right)^2 \]  
(24)

where

\[ X = X_1 + X_2. \]  
(25)

This leads to a solution with

\[ X_1 = X_2 = \frac{X}{2} = \frac{a}{2(2b+c)}. \]  
(26)

Finally, the Stackelberg solution may be derived by assuming the second firm (the Stackelberg follower) uses a version of equation (21)—behaving in a 'Cournotesque' way, in Kahn's terminology—to set its output, given the output of Firm 1:

\[ X_2 = \frac{a - bX_1}{2(b+c)}. \]  
(27)

Firm 1 then exploits this in order to maximise

\[ \Pi_1 = X_1\left(a - b\left[X_1 + \frac{a - bX_1}{2(b+c)}\right]\right) - cX_1^2 \]  
(28)

1 This solution assumes the two firms produce equal outputs; other distributions of output between the two firms will lead to different outcomes, though in this case the equal output solution maximises total profits.
Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Price</th>
<th>Output</th>
<th>$X_1$</th>
<th>$X_2$</th>
<th>$\Pi_1$</th>
<th>$\Pi_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bertrand</td>
<td>5.00</td>
<td>5.00</td>
<td>2.50</td>
<td>2.50</td>
<td>6.25</td>
<td>6.25</td>
</tr>
<tr>
<td>Kahn</td>
<td>5.33</td>
<td>4.67</td>
<td>2.00</td>
<td>2.67</td>
<td>6.67</td>
<td>7.10</td>
</tr>
<tr>
<td>Stackelberg</td>
<td>5.89</td>
<td>4.11</td>
<td>2.14</td>
<td>1.96</td>
<td>8.04</td>
<td>7.72</td>
</tr>
<tr>
<td>Cournot</td>
<td>6.00</td>
<td>4.00</td>
<td>2.00</td>
<td>2.00</td>
<td>8.00</td>
<td>8.00</td>
</tr>
<tr>
<td>Collusion</td>
<td>6.67</td>
<td>3.33</td>
<td>1.67</td>
<td>1.67</td>
<td>8.33</td>
<td>8.33</td>
</tr>
</tbody>
</table>

This leads to

$$X_1 = \frac{a(b+2c)}{2(b^2+4bc+2c^2)}$$  \hspace{1cm} (29)

and

$$X_2 = \frac{a(b^2+6bc+4c^2)}{4(b^2+4bc+2c^2)(b+c)}$$ \hspace{1cm} (30)

In this case, the profits of the leader are greater than those of the follower while, as Kahn notes, prices are higher and total profits greater than his ‘Bertrand-esque’ case. Kahn points out that both these asymmetric solutions lie between the ‘extreme’ Cournot and Bertrand equilibria when ranked by whether they are more or less ‘monopolistic’ in the sense of prices and total industry profits being higher.\(^1\) To illustrate, let $a = 10$ and $b = c = 1$. We then obtain outcomes in Table 1.

The distribution of output over firms in an industry is further complicated by the possibility that some firms are capacity-constrained. Kahn dealt with this problem in Chapter 9 of his dissertation. He considered a number of cases of increasing generality: first, that all firms are identical; second, that firms have the same (constant) prime costs and face the same ‘annihilation coefficient’ but have different capacities; and third, that while the ‘annihilation coefficient’ is common to different firms, they have different costs and sizes. Finally, he examined the case where firms have different capacities and some firms are capacity-constrained.\(^2\) The relationship between price, prime cost and capacity utilisation he obtained for an individual firm carries over to the industry in the first two cases and even in the third case if suitable (weighted by capacity) values of these three variables are used. However, complications arise in the fourth case, since the fact that some firms are capacity-constrained will change the ‘annihilation coefficients’ of unconstrained firms. Nevertheless, Kahn felt that the data he had on the cotton industry showed that these complications were not serious enough to prevent the application of his equation (1) above to the industry as a whole and that there was good evidence that, in the period after September 1927 when the Cotton Yarn Association’s price support scheme collapsed, ‘in the spinning of medium counts of American cotton the

\(^1\)Kahn also considers an intermediate type of behaviour lying between the two asymmetric (‘Bertrand-esque’ and ‘Cournot-esque’) cases which happens to be symmetric, but argues that it would arise only as a result of coincidence and so therefore cannot be a solution to the problem of duopoly (Kahn, 1937, p. 20).

\(^2\)He also considered the possibility that firms may decide to produce at a level above zero to ‘maintain connections’ with customers, even though zero output would reduce losses and so might appear optimal in the short run.
 imperfection of the market is a major influence in determining the position of equilibrium’ (Kahn, 1989, p. 148). 

The effect of a change in wages

Two major propositions in Kahn’s dissertation were that prime cost and not overhead cost determines price and that the relationship between a change in prime cost and a change in price depends on the degree of imperfection of the market. Together they allowed him in Chapter 10 to analyse the effect of changes in wage rates on output and profits. He argues that ‘the efficacy (in reducing losses) of a wage reduction, or the perniciousness of a wage increase, is in direct proportion to the imperfection of the market and to the elasticity of the aggregate demand’ (Kahn, 1989, p. 150). Moreover, since firms with low prime costs will be operating closer to full capacity and, on Kahn’s assumptions, each firm’s output increases by the same proportion of its capacity output, it follows that ‘an increase in demand or a reduction of wages confers the greatest benefits on those firms which require them least’ (p. 152).

Kahn returned to the question of changes in wage rates in an unpublished paper, entitled ‘The Effect on Employment of a Reduction in Wages in a Closed System’, which he wrote while (or soon after) working on the cotton industry for his dissertation. The paper attempted to extend the analysis of changes in money wage rates to the long period after a brief discussion of short-period considerations. Kahn begins by identifying three ways in which a reduction in wages might alter the volume of employment. The first involves a change in the volume of output, the second involves a change in the ratio of labour to capital in the production of a given volume of output, while the third involves

1 Newman (1986), reviewing Kahn (1983), judges that Kahn’s empirical results ‘bordered on the miraculous’ thought it should be noted that Kahn (1989, p. 144, n.2) was cautious about attaching too much significance to his results.

2 Kahn had examined the case of an industry operating below capacity when the market is perfect in Chapter 6. There he argued that, when price equals average prime cost, the loss of each firm is equal to its total fixed cost and is independent of its level of prime cost and of its output. ‘[S]o long as the output of the industry remains below the capacity output, changes in demand and such changes in prime cost as affect the whole industry equally should be matters of indifference to the employers. On the other hand, by reason of their effect on employment, they should be matters of keen interest to the workers’ (Kahn, 1989, p. 67-8; Kahn’s emphasis). In contrast, at full capacity the level of wages has no effect on the price in the short period and ‘[a]n increase in wages falls wholly on profits and the employers have every incentive to resist it’ (p. 69).

3 Kahn shows that this result carries over to the case where a highly efficient firm is capacity constrained.

4 The paper, a typescript of which is in the Joan Robinson Papers, King’s College, Cambridge, is undated. The typescript has a comment in her hand: ‘Early work by RFK’. References to the cotton industry (pp. 2-3) recall Kahn’s dissertation while the absence of any reference to the analysis of interest rates in Keynes’s Treatise on Money (1930) or to the elasticity of substitution (compare Kahn, 1933 and Robinson, 1936, 1937) suggest a date early in Kahn’s career as an economist. When I discussed the paper with Lord Kahn in September 1984 he was unable to recall when the paper was written though he deduced from its argument that it must have been before he saw Keynes’s Treatise on Money. This would imply composition in 1929, that is before the dissertation was submitted. As Maneschi (1988, p. 157, n. 6) notes, Kahn played down his role in the composition of the Treatise, saying that ‘Keynes did not want to divert me from writing my dissertation, and it was only after December 1929 that he started giving me for comments the proofs of the Treatise’. However, a letter from Kahn to Keynes dated 29 September 1929 (J.M.K. XXIX, p. 4) makes it clear that Kahn had seen proofs at that stage, while the preface Keynes drafted for a single-volume version of the Treatise (August 1929) contains an acknowledgement of Kahn’s ‘care and accuracy’ ... in helping to discover ‘innumerable mistakes and muddles’ (J.M.K. XIII, p. 83). Finally, it is of interest to note that Kahn’s multiplier article (Kahn, 1931) contains a reference to a future article that would contain ‘an analysis of the effect of a rise in wages on the level of employment’ though, as Kahn notes in the reprinted version of this article ‘no note or article on this subject was written’ (Kahn, 1972, p. 3, n. 1). It could well be the case that this reference was based on the fact that Kahn had intended to work up ‘The Effect Of Employment of a Reduction of Wages in a Closed System’ for publication but that he decided subsequently to abandon it.
a change in the composition of output, so that more labour-intensive and fewer
capital-intensive commodities are demanded. However, the third of these mechanisms is
given no further consideration.¹

As far as the second mechanism is concerned, Kahn notes that, in the short period, the
quantity of labour required to produce a given output is more or less fixed by technical
requirements,² but, in the long period, changes in the optimum proportions of factors
have to be considered. The traditional Marshallian approach to this problem was to
argue that, if wages were lower, capital would be used in less labour-saving ways and that
there must be a level of wages at which all the available labour would be employed.³
Increasing employment would require a fall in the wage and a rise in the rate of interest
so that each factor received its marginal product. Against this, Kahn raises the objection
that, when wages fall, so too will prime costs and hence prices in the capital-goods
producing sector of the economy. According to Kahn, the rate of interest is not the price
of capital in the same way that wages are the price of labour;⁴ the appropriate price is the
rate of interest multiplied by the price of capital goods. If the price of capital goods falls
in proportion to a fall in wages, the marginal productivity of capital remains unchanged
and there is nothing to induce a shift in the capital-labour ratio.⁵ By the same token, if
the prices of consumption goods have also fallen in the same proportion, real wages will
be unchanged. Kahn concludes: ‘real wages cannot be altered by altering the money-
wages; to lower real wages and increase employment it is necessary to raise the rate of
interest’ (p. 7).

To trace out the effect of a change in money wages on the rate of interest, Kahn
distinguishes two cases. In the first, all money wages are cut simultaneously. This was the
case that those who were advocating such a policy had in mind, but, as Kahn points out,
there will be no effect on real wages. The second possibility is that some ‘process of
underbidding’ works to lower real wages as well as money-wages, raise the rate of interest
and increase employment. Kahn believes there may be such a mechanism, but he does
not specify how it would work. Moreover, assuming it does work, we are left with a
paradox:

If labour were perfectly combined and completely subservient to a single Common Rule governing
the whole field of labour, it would be impossible by Trade Union action or government fiat,
operating on the general level of wages, to increase employment. It is only by breaking its united
front that labour can secure more employment and lower real-wages. (p. 9)

¹ He points out that this may be rationalised by assuming the same capital-labour ratio in the production
of all commodities and the same cost curves for all commodities.
² An exception occurs when prime costs include items other than wages, but, Kahn claims, in a closed
system all prime costs can be reduced to wages.
³ This theory required the concept of a given quantity of capital, independent of its composition in terms
of particular capital goods and independent of the rate of interest. Kahn was aware of the objections Sraffa
had raised about this concept of capital, but he put them to one side in this paper: ‘Whether it is logically
possible to speak of a fixed stock of capital when its constitution and the rate of interest alter—I am assured
by Mr Sraffa that it is quite impossible—and whether such an assumption, if it has any meaning is of any
practical significance, are fundamental difficulties in the Theory of Distribution that it is necessary to ignore’
(p. 6a, n. 1). It is of interest to note that Kahn was not aware that the assumption he had made earlier, that
all commodities are produced using labour in equal proportions, is the very assumption required for a fixed
quantity of capital to be defined.
⁴ Bliss (1990, p. 233) puts forward a similar criticism of Marshall’s theory of capital in the course of a
discussion of an increase in the demand for capital: ‘insofar as the demand and supply of capital goods are
arranged through the price system, we can discuss the impact on prices. It is not immediately obvious why
there should be any effect on the rate of interest’.
⁵ Kahn discusses the case of perfect competition but claims that ‘a substantially identical proposition
could doubtless be evolved for the cases where competition is not perfect’ (p. 6).
Economics of the short period

Kahn then attacks the problem in a different way by considering a situation in which an excess supply of labour will have the appropriate effect on the demand for capital. This situation arises when each worker is self-employed and owns, or hires, the appliances of production. An increase in the supply of labour will cause the rate of interest to rise until the fixed stock of capital is employed in less labour-saving forms:

"At the higher rate of interest it will no longer be profitable to wield such a large spade as before, with the result that spades will be much smaller and there will be more spades available. Corresponding to the higher rate of interest that each man has to pay for his capital, he has to suffer a fall in real wages that is the net reward of his labour. The existence of long-period unemployment is then simply to be ascribed to the refusal on the part of a certain section of the labour supply to work for the real return which their efforts would yield to them." (p. 11)

When firms are controlled by entrepreneurs, however, the situation is different. Unemployment need no longer be voluntary. Unemployed workers may be anxious to work at the current real wage, but employers may not be willing to employ them. But here is another paradox. There is, Kahn claims, the same unique relationship between employment, the rate of interest and real wages in both situations; why should the introduction of employers make this difference? Kahn's answer is that, in this case, it is difficult to show how the employer's demand for capital is related to the worker's willingness to supply labour.

If workers agree to not accept a money wage below that current in the market, there is no mechanism to increase the employer's demand for capital. For the employer to demand more capital, there must be 'underbidding', but again Kahn is unclear about how this might work. If 'underbidding' does occur, a new position of equilibrium can be reached in which all who are willing to work have employment. How far money wages have to fall for this to happen is indeterminate: 'the magnitude of the fall in money wages that has occurred in the process of change is an irrelevant element, and in the limiting case of perfect underbidding there is no appreciable fall at all' (p. 14).

Kahn's paper introduces a number of themes that were to remain central concerns in the development of Keynesian theory. The concept of a more-or-less uniform fall in money wages rates reacting—via prime costs—on prices is deployed by Keynes in Chapter 19 of *The General Theory*. Keynes, too, explored links between such a process and the rate of interest, although the mechanism he identified involved a *fall* in the rate of interest which increased employment via an increase in investment demand. Both Kahn and Keynes were sceptical about the usefulness of cutting money wages in order to increase employment, although their reasons were quite different. The distinction Kahn introduced between voluntary and involuntary unemployment—though without using these terms—is also central to *The General Theory*.

Less successful were Kahn's attempts to deploy the Marshallian theory of capital in a long-period analysis. Kahn was aware of some of the logical difficulties in the theory that Sraffa had identified, though not all the implications of Sraffa's criticisms. He was also aware of the paradox of trying to *raise* the rate of interest in order to increase employment when entrepreneurs themselves were calling for a *fall* in interest rates as a means to achieving the same end.¹ The counter-intuitive implications of the long-period theory he

¹ Based on the empirical investigations he had undertaken for his dissertation, Kahn was sceptical about the efficacy of cutting interest rates, since he regarded interest costs as part of fixed rather than prime costs, and argued that the latter and not the former determined output and employment in the short period. Better reasons for associating increased employment with lower interest rates would be suggested by the *Treatise on Money* and developed in *The General Theory*. 
was using are announced with much less confidence than he expressed in the dissertation when he presented the counter-intuitive results of his short-period analysis. It is possible that the difficulties he experienced applying Marshall's long-period theory to the problem of increasing employment led Kahn to abandon this approach and return, when he next considered this problem,\(^1\) to the short-period method he had used in his dissertation.

Conclusion

Kahn's development of Marshall's concept of the short period gave Keynes an important tool which was used to great effect in *The General Theory*.\(^2\) Rejecting Marshall's emphasis on a relatively quick adjustment to a position of long-period equilibrium, Kahn stressed the empirical relevance of the concept of short-period equilibrium, especially when the required adjustment was in a downwards direction. Since, in the short period, the quantity of labour required to produce a given output is mainly determined by technical considerations, there is no question of factor substitution. The difficulties in the Marshallian theory of distribution identified by Sraffa do not arise. In the short period, with a given stock of equipment, changes in the level of output that occur as a consequence of changes in employment allow a marginal product of labour to be defined. Since changes in the capital stock are not considered, there is no occasion for defining a marginal product of capital. No logical difficulties are created by assuming that the real wage is equal to the marginal product of labour and that profits (net of user cost) are equal to output less wages.

There remains the question of adapting Marshall's short-period analysis to deal with market imperfections. Kahn showed that, even in what appeared to be a paradigm of a competitive industry, market imperfections played an important role in determining equilibrium levels of price and output and the distribution of output among firms. However, this feature of Kahn's analysis was not carried over into *The General Theory*. Kahn had established that the shape of an industry's supply curve would depend not only on familiar cost considerations but also on the conjectures firms entertained about other firms' behaviour. He attempted to narrow down the range of conjectures which it would be rational for firms to adopt, but he recognised that a unique solution to this problem would remain elusive. From the point of view of tractability, the most that could be hoped for was that the degree of market imperfection would remain fairly constant when demand changed. However, if firms were of different efficiencies and were operating with different degrees of capacity utilisation, the degree of market imperfection could itself change with demand.

Keynes, following Kahn, could have considered an economy where all firms were similar, perhaps with reverse-L shaped cost curves, and were operating well below full capacity. This would have allowed him to deal with the question of market imperfection, but at some cost to realism. While such a picture may have been an appropriate

---

\(^1\) In Kahn (1931), his first published article.

\(^2\) Keynes's specification of the short period was as follows: 'We take as given the existing skill and quantity of available labour, the existing quality and quantity of available equipment, the existing technique, the degree of competition, the tastes and habits of the consumer, the discontinuity of different intensities of labour and the activities of supervision and organisation, as well as the social structure including the forces, other than the variables set forth below, which determine the distribution of national income. This does not mean that we assume these factors to be constant, but merely that, in this place and context, we are not considering or taking into account the effects and consequences of changes in them' (J.M.K. VII, p. 245). Keynes implicitly assumes that the available equipment will be appropriate for the production of full-employment output.
description of the cotton industry at the time Kahn investigated it, it would not do for the whole economy. Keynes chose, instead, to accommodate firms with a wide range of short-run cost functions. A tractable aggregate supply function was obtained by assuming—again, unrealistically—that firms treated the goods market as perfectly competitive and so produced up to the point where expected price equalled marginal factor cost. Plant would be used in order of efficiency and there would be determinate, monotonic relationships between output and price and between output and employment.

Was this the right choice? Writing nearly fifty years after submitting his dissertation, Kahn (1977, p. 379, n.) returned to this question, criticising Malinvaud (1977) for using just such a supply curve: 'There was an element of "rising supply price" in Keynes' aggregate supply function, but it is not essential to the main argument. It was criticised on empirical grounds as soon as the General Theory was published.' In fact, there are good reasons for attempting to incorporate the fact that there will be, at any given moment, firms in existence with plants of varying efficiencies and the fact that these firms will be operating in markets with different degrees of imperfection. An implication is that the distribution of output over plants need not be efficient. Moreover, decisions to invest in new plants or scrap old plants and to hire, train or dismiss workers, in such circumstances may well lead to a situation where the 'existing skill and quantity of available labour [and] the existing quality and quantity of available equipment' are no longer appropriate to the production of full-employment output. This complicates short-period analysis, but does not invalidate the approach. Nor should the fact that such changes occur in the factors traditionally held constant in short-period analysis be taken to suggest that the focus should shift to positions of long-period equilibrium. There is no mechanism that ensures that changes of this type will form part of an adjustment process to a new long-period equilibrium position. On the contrary, the existence of a short-period equilibrium at less than full employment constitutes a serious impediment to such an adjustment, as Kahn recognised in 1929 when he discussed the 'long end of the short period'.

Bibliography

Kahn, R. F. 1929. 'The Economics of the Short Period', Unpublished Fellowship Dissertation, King's College, Cambridge
Kahn, R. F. 1931. The relation of home investment to unemployment, Economic Journal, June
Kahn, R. F. 1933. The elasticity of substitution and the relative share of a factor, Review of Economic Studies, October
Kahn, R. F. 1937. The problem of duopoly, Economic Journal, March
T. J. O'Shaughnessy

Robinson, J. 1936. The long-period theory of employment, *Zeitschrift für Nationalökonomie*
Sraffa, P. 1926. The laws of returns under competitive conditions, *Economic Journal*, December