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Production, Planning and Prices

By
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Abstract

Firms do not exist because of the cost of using the price mechanism, but because they enable actions to be carried out concurrently in conformity with a particular design. This concurrent coordination, which production requires, is distinct from the evolutionary coordination, which is the unintended consequence of market transactions. The two processes are alternatives only to a limited extent. Evolutionary adjustment cannot bring about concurrent coordination, and irreducible uncertainty limits the scope of the planning which does.

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Introductory

1. It may be useful to summarise, in advance, my central argument. Firms do not exist, as has been claimed, because of the cost of using the price mechanism, but because they make it possible for a complex set of actions to be carried out concurrently and in conformity with a particular design. The nature of this *concurrent coordination*, which is necessary for the production of goods, is such that it can never come about spontaneously as an unintended consequence of market transactions. It requires the organisation and planning that firms typically provide. These firms, which internally provide concurrent coordination, also buy and sell on competitive markets, and the indirect consequence of their transactions is to bring about a spontaneous ordering of the kinds and quantities of goods in production. The market mechanism, that is to say, does not replace planning by firms but, by influencing the plans they make, regulates the pattern of production throughout the economy. The process by which it does so is sequential or *evolutionary*¹, change being brought about gradually through the interaction of successive decisions taken independently. Spontaneous, evolutionary coordination and planned, intra-firm coordination are alternatives only to a limited extent. Evolutionary adjustment cannot bring about concurrent coordination, and irreducible uncertainty limits the scope of the planning which does.

Evolutionary versus Concurrent Coordination

2. According to Ronald Coase, "The main reason why it is profitable to establish a firm would seem to be that there is a cost of using the price mechanism".² Although this proposition has proved exceedingly influential, having given rise to a school of thought prominent in the analysis of industrial structures, it seems to me misleading. It cannot mean that a costless price mechanism would enable us to dispense with purposeful activity; it can only mean, presumably, that, in the absence of transactions costs, purposeful activity would be required only from inter-trading individuals, there being no need for organised

¹ I use the word evolutionary, in its non- scientific, non-Darwinian sense, to describe an evolving process which takes place gradually through successive incremental adjustments, no reference to mutation or selection being implied.

² R.H. Coase; *The Nature of the Firm*, *Economica* 4 1937, pp 386-405.

cooperation between them such as takes place within firms. But this proposition, I hope to show, is false.

3. Transformation, like baking a cake, can be carried out through a planned series of operations, on the basis of appropriate knowledge, by one person. But for more complex operations, several people have to cooperate. They must have appropriate knowledge and their activities must be so fitted together as to conform to an appropriate plan. The activities, in other words, have to be subject to coordination which is both concurrent and continuous. Activities can sometimes be coordinated by sequential adjustments, each new activity justifying itself, in profit terms, in relation to activities which are already being undertaken or can safely be assumed to be about to be undertaken. But we have only to think of the set of activities that take place, for example, within a factory, to appreciate that the required pattern of relationship cannot always be brought about this way. In that context, the rationale of any one activity depends upon a whole set of activities, of which it is a member, being undertaken at the same time. There has to be a design, and organised cooperation is required to provide the *concurrent* coordination needed to bring activities in correspondence with it. Such coordination, as well as being concurrent, also has to be *continuous*. In the production of goods, it is not enough to put a set of activities into an appropriate mutual relationship and expect it to remain appropriate. The actions of those engaged in organised cooperation have continuously to adapt to changing circumstances and in a coordinated fashion. I shall have more to say later about the nature of this organised cooperation, my immediate purpose being to mark the difference between coordination which can come about gradually, as the unintended consequence of independent decision -taking, and coordination which, having to be concurrent and continuous, requires planning. The supply of cars, for example, can, in favourable circumstances, come spontaneously into line with the demand for them, as the consequence of decisions taken independently, in the hope of profit and subject to no over-arching plan. And the supply of components for car production can likewise come into spontaneous adjustment. In the manufacture of these components, however, and their assembly into cars, continuous, concurrent coordination, and therefore organised cooperation, is required.

The Process of Concurrent Coordination

4. Some concurrent coordination can be brought about by cooperative arrangements other than those which define a firm. Two or more individuals can concurrently coordinate their activities simply through mutual undertakings, each committing himself appropriately in advance. And firms can coordinate their activities by means of what I have described in an earlier article as a "dense network of cooperation and affiliation".³ But if the number of cooperating individuals is large, and the required coordination is continuous and complex, cooperation has to be arranged as in a firm, through a set of characteristic contracts, of the kind discussed by Ronald Coase and subsequently. These contracts provide, among other things, for the division, between cooperating parties, of the revenue from their joint activity; this important function of the firm is much discussed in the literature and I shall not be concerned further with it here. Related to this is the need to align, through rewards and penalties, the personal interests of the cooperating parties with the aims of the organisation. I shall not be concerned with this issue also, not because it is unimportant, but in order to concentrate on other matters, perhaps more fundamental. Even if there were no conflict between the interests of the parties concerned, their activities would still have to be coordinated in accordance with a *conscious design*. And this need could only be met by setting up a firm, conscious design being a distinct management function exercised, not only by the board of directors, but at different levels throughout the organisation, hierarchically.

5. Concurrent coordination can sometimes be brought about, I have observed, by cooperation other than that organised as in a firm. This does not mean, however, that it is produced by "the price mechanism". The important distinction, it seems to me, is between planned coordination achieved through cooperation, whether or not organised in a firm, and unplanned coordination that comes about spontaneously as the indirect and unintended consequence of actions taken independently. In the 1972 article I earlier referred to, I describe the "orchestration of development, manufacture and marketing [which] takes place without any shareholdings by Marks and Spencer in its suppliers and without even long-term contracts". Planned coordination can be effected, in appropriate circumstances, through

³ "The Organisation of Industry", G.B.Richardson, in the *Economic Journal*, Vol.82, September 1972, pps.883-896.

cooperation between, rather than within firms, but it is wrong to associate it with the spontaneous, unplanned coordination resulting from independent market transactions. It is for this reason that I find Coase's distinction between "firm" and "the price mechanism" to be so misleading. Marks and Spencer plan and achieve the coordination of activities that are not grouped as in a firm, but the credit for doing so is due to its management rather than to "markets", "the price mechanism" or "the invisible hand".

6. Those engaged in cooperation have particular functions, these being related to the *knowledge* they possess⁴. They will require professional knowledge, or technical skill, of one kind or another, but if their cooperation is to be effective, they must also possess what, for want of a better term, one may call *local knowledge*, knowledge, that is, of those with whom they have to deal and of the rules and roles of the organisation. Coordination between the activities of different people cannot be obtained by telling each of them precisely what to do, but will depend on how they inter-act with fellow-members of their team, in accordance with prescribed roles and rules, in response to changing and unforeseen circumstances. For this reason, the effectiveness of a firm depends not only on the professional and technical knowledge and skills of its members, but also on the local knowledge which they have gained from working with each other. The effectiveness of a firm, in other words, depends, in part, on the way in which those working for it are inter-related, and therefore on the quality of its organisation. The stability of the relationships in place is of obvious importance from this point of view; a computer programmer, a salesmen, an accountant, or an editor may be on the payroll of a firm, or may be assigned to it by another firm paid to provide a particular, specialised service, or may work free-lance, perhaps on a commission basis. According to the terms of the relevant contract, he may, or may not, "belong" to the firm, but the formal position may be less important to his effectiveness than the degree of stability and commitment characterising his relationships with those with whom he has to cooperate. For this reason, the firm, in operational terms, need not be coincident with the

⁴ My own thinking about economic organisation has been profoundly affected by Hayek's observation that the knowledge available to a society was dispersed among many minds, markets being a means by which it is harnessed. People specialise, he pointed out, on activities they know about, and then sell their product on the open market for money, which they can use to buy from those who specialise on other activities. But Hayek does not say much about how the dispersion of knowledge is also harnessed by the organised cooperation, within firms, of those who possess it. Nor does he have much to say about the division of labour between these two different ways of harnessing knowledge. This is the issue which, in this paper, I seek to address. Hayek's analysis is in his paper, *Economics and Knowledge*, *Economica* 1937.

particular network of contracts which formally define it. Members of a firm, through working for it for a period, come to provide a service which, by virtue of that experience, is in some degree specialised, and no longer completely equivalent to a service that which could be bought in the open market. The value of this specialisation will, of course, differ according to the function concerned, being less in the provision of, say, catering or cleaning services than in the case of those engaged in the core activities of production. One should also recognise that there is an optimum degree of stability in the relationships within an organisation; procedures must not harden into fixed routine, a change of jobs may provide re-juvenation, and organisations can gain from the transfusion of new blood. Without some degree of stability, however, organised cooperation would not work.

7. A firm, like a nation state, but to a much lesser degree, is organic in character, and our understanding of it is impoverished by exclusive concentration on the contracts with which it is associated. It has a life of its own, to the extent that it embodies and passes on traditions independent of its transient membership. And by virtue of the knowledge, skills and experience of its membership, of the character of its organisation, and of its external connections and reputation, a firm becomes possessed of particular *capabilities*, defined in terms of the kinds of business in which it is engaged and of the other kinds of business in which it would have a comparative advantage over firms generally. Organised cooperation is required, I have argued, in order to bring about the concurrent coordination required to produce goods, but by effecting coordination in particular contexts, a firm acquires experience which can be applied in other contexts. I have said that firms are required in order to provide concurrent coordination, but such coordination is not commonly necessary in relation to the entirety of the activities which it undertakes. Thus the need for concurrent coordination, which gives the firm its essential rationale, will not explain, at any time, the full range of its activities. The justification for combining activities may reside, not in their *complementarity*, or vertical relationship in a process of production, but in their *similarity*, in the sense that they require, or have been believed to require, the same capabilities for their successful undertaking. It is worth bearing in mind, however, that we should not expect to find a current logical justification for the pattern of business which a firm may, at any particular time, be engaged in. A firm's range of activities may reflect the industrial logic of a former time, and may persist after the logic no longer holds, just as animals may retain characteristics which no longer provide, as previously, a selective advantage - or may retain

them, at any rate, for so long as no positive competitive disadvantage is suffered. Oxford University Press has exhibited, over the centuries, mutations of this kind; at one time, it was believed expedient to seek to subject the activities of publishing, printing and paper making to concurrent coordination, despite their great *dissimilarity*. OUP itself printed the books which it published, on paper from its own mill and with ink made in-house. By the middle of this century, the links between these stages of production became increasingly tenuous, coordination was gradually abandoned, and both printing and paper making were run as distinct businesses selling in the open market. But this dispensation did not last; it became apparent that the way ahead was in expansion in publishing, along the line of the central capability, and in the abandonment of the related, but very dissimilar, activities of printing and paper making.

8. The process of transformation therefore, if it is at all complex, is undertaken by a tolerably stable cooperating group, possessing, collectively, particular capabilities, there having been created a framework of roles and roles calculated to ensure that cooperation will produce the designed result. The question then arises as to what particular stages in the process of transformation the firm will undertake. If we have in mind a model of the process of transformation according to which a firm converts some original "factors of production" directly into final consumer goods. then the issue does not arise. In reality, of course, the manufacture of any good, whether it be a shirt or a submarine, involves innumerable stages of transformation, all of which no one firm could ever conceivably itself undertake. And, of course, these stages are inter-related in a complex manner; the production of a shirt does not come about through a linear series of stages of transformation in, each of which being peculiar to that series. On the contrary, any one process of transformation, such as the manufacture of chemicals to dye the shirt, is likely to be a stage in a countless number of quite different processes of production. So complex is the inter-linking, indeed, that it would scarcely be possible to specify all the processes of transformation that enter into what we call the "production" of any particular consumer good.

The Process of Evolutionary Coordination

9. Transformation itself is carried out, as we have seen, by the planned and purposeful activity that takes place within firms. The complex inter-linkage throughout the economy of

different stages of transformation develops either spontaneously through market transactions, or through inter-firm cooperation. Linkage is facilitated by the emergence of intermediate goods, through the separating out, that is to say, of particular stages in the process of production, so as to make available goods suitable for use in other stages of production.⁵ If these intermediate goods are in general demand, they are produced "for the market", without the security offered by long-term contracts, but if they are made specifically for one particular purpose, then inter-firm cooperation is required.

10. I have distinguished between *concurrent coordination*, which is brought about through intra-firm or inter-firm cooperation, and *evolutionary coordination*, which spontaneously links different stages of production. I have already expressed my dissatisfaction with the distinction, made by Coase and others, between coordination, within the firm, by "the entrepreneur", and coordination, through market transactions, by means of "the price mechanism". By putting the matter in this way, the impression is created, first, that prices have no role to play in the process of coordination that takes place within firms and, secondly, that they in themselves are sufficient to bring about coordination outside them. The first proposition is misleading. No one disputes that planned coordination within a firm takes account of the prices at which inputs are purchased and outputs sold. Beyond that, however, and in order to make rational use of those intermediate goods and services which the firm itself both produces and uses, it is possible to establish departmental "profit centres" which inter-trade at notional transfer prices set either by agreement between them, or by those to whom they are responsible, or in accordance with corresponding prices on open markets. The second proposition, that prices can by themselves effect coordination, is also misleading. It suggests that current prices coordinate economic activity by providing firms with clear and sufficient signals about what production decisions they should take.⁶ But the prevailing prices for a good are relevant to such decisions only to the extent that they provide a useful indication of what prices will be when the good is produced and comes to

⁵ The way in which the division of labour among firms increases total output and thereby provides the opportunity for further division of labour is famously described by Adam Smith, for whom it represented, in modern terminology, a self-sustaining process of endogenous growth. *Vide* my paper "Adam Smith on Competition and Increasing Returns", in *Essays on Adam Smith*, edited by Andrew Skinner and Thomas Wilson, Clarendon Press, Oxford, 1975.

⁶ "In an ideally functioning system of markets, all that anyone needs to know is his or her own capabilities and tastes and prevailing prices". *Vide* "Economics, Organisation and Management", by Paul Milgrom and John Roberts, Prentice Hall International 1992, p.27.

be sold, and this they will do only if there is reason to believe that the circumstances affecting prices are not likely greatly to change. For the signalling provided by prices to work, that is to say, it is necessary to have that stability or continuity in the relevant economic environment which, we observed earlier, was a condition necessary for incremental or evolutionary adjustment. The distinction between coordination within a firm, and coordination through market transactions, has to do not with whether prices have a role to play in the process, but with whether the coordination required has to be concurrent or can proceed on an incremental or evolutionary basis.

The Role of Prices

11. It is, of course, possible to claim that prices do contain all the information on which to base production decisions, provided they are understood to relate not only to goods currently available, but also to goods available at future dates or according to different "states of the world"; thus we have prices for "jam -today", "jam tomorrow", "umbrellas- when -it - is - raining", "umbrellas- when - it - is - sunny" and so on. But although a construction of this kind may save the neo-classical model,⁷ it is, for the most part, an evasion. It is hard to see how firms could know the prices at which they can expect to sell goods at a future date, other than by having entered into contracts with buyers; the coordination of their plans in this case would however been then have been achieved, effectively, through cooperation rather than spot market transactions. Prices by themselves can only be made to appear able to coordinate activities, in such a case, through failure to disclose the planning that has to go on behind the scenes. Neither concurrent or evolutionary coordination will develop rationally without the mediation of market prices; these prices, however, do not represent a signalling mechanism sufficient in itself to promote the coordination of related activities and, by featuring them as such, the need for either cooperation or continuity is obscured.

12. Markets enable us, as pointed out by Hayek and others, to exploit the knowledge which is uncertain and dispersed among many minds. But so do firms, in a quite different way. The division of labour, to put it differently, is practised both among businesses and within them; the required subsequent integration is achieved, in the former case, through market

⁷ Op. Cit. p.68.

transactions, and, in the latter, through organised cooperation. Organised cooperation reduces uncertainty by arranging that each activity within a set of complementary activities will be appropriately matched, most simply, by an exchange of promises between two people, or, in a more complex context, by cooperation within a firm according to a prescribed design. Markets reduce uncertainty in an entirely different manner, which depends on the stability which aggregates may be expected to have in appropriate circumstances. Typically, the producer of a consumer good relies, not on promises to buy from individual customers, but on their future aggregate demand being sufficiently predictable. Similarly, a firm that decides to purchase a required input on the market, rather than produce it itself, relies on the aggregate future supply of that input being sufficiently predictable. There is no attempt to foresee, or secure through contracting, purchases or offers from single buyers or sellers, reliance being put on the predictability of the aggregate demand and supply of goods which are bought and sold by many people. Trading in these goods, in competitive markets, establishes prices which, by influencing the plans of firms and consumers, modulate production throughout the economy, not only in terms of the quantities being produced of goods currently available, but in terms also of the structure of production, as characterised by the degree of specialisation and the consequent variety of intermediate goods.

13. Each of us can endeavour to reduce uncertainty about what other people will do by exchanging undertakings with them, but only at the price of reducing also the freedom of manoeuvre with which we hope to cope with uncertainty of a more general kind. The scope for planned coordination is limited by this circumstance, at the point where the balance of advantage tips towards relying on the stability of aggregates, upon which the prospect of successful spot transactions necessarily depends. Neither procedure can free us from the possibility of surprises, but we need both of them in order to negotiate an uncertain world.

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Danish **R**esearch **U**nit for **I**ndustrial **D**ynamics

The Research Programme

The DRUID-research programme is organised in 3 different research themes:

- *The firm as a learning organisation*
- *Competence building and inter-firm dynamics*
- *The learning economy and the competitiveness of systems of innovation*

In each of the three areas there is one strategic theoretical and one central empirical and policy oriented orientation.

Theme A: The firm as a learning organisation

The theoretical perspective confronts and combines the resource-based view (Penrose, 1959) with recent approaches where the focus is on learning and the dynamic capabilities of the firm (Dosi, Teece and Winter, 1992). The aim of this theoretical work is to develop an analytical understanding of the firm as a learning organisation.

The empirical and policy issues relate to the nexus technology, productivity, organisational change and human resources. More insight in the dynamic interplay between these factors at the level of the firm is crucial to understand international differences in performance at the macro level in terms of economic growth and employment.

Theme B: Competence building and inter-firm dynamics

The theoretical perspective relates to the dynamics of the inter-firm division of labour and the formation of network relationships between firms. An attempt will be made to develop evolutionary models with Schumpeterian innovations as the motor driving a Marshallian evolution of the division of labour.

The empirical and policy issues relate the formation of knowledge-intensive regional and sectoral networks of firms to competitiveness and structural change. Data on the structure of production will be combined with indicators of knowledge and learning. IO-matrixes which include flows of knowledge and new technologies will be developed and supplemented by data from case-studies and questionnaires.

Theme C: The learning economy and the competitiveness of systems of innovation.

The third theme aims at a stronger conceptual and theoretical base for new concepts such as 'systems of innovation' and 'the learning economy' and to link these concepts to the ecological dimension. The focus is on the interaction between institutional and technical change in a specified geographical space. An attempt will be made to synthesise theories of economic development emphasising the role of science based-sectors with those emphasising learning-by-producing and the growing knowledge-intensity of all economic activities.

The main empirical and policy issues are related to changes in the local dimensions of innovation and learning. What remains of the relative autonomy of national systems of innovation? Is there a tendency towards convergence or divergence in the specialisation in trade, production, innovation and in the knowledge base itself when we compare regions and nations?

The Ph.D.-programme

There are at present more than 10 Ph.D.-students working in close connection to the DRUID research programme. DRUID organises regularly specific Ph.D-activities such as workshops, seminars and courses, often in a co-operation with other Danish or international institutes. Also important is the role of DRUID as an environment which stimulates the Ph.D.-students to become creative and effective. This involves several elements:

- access to the international network in the form of visiting fellows and visits at the sister institutions
- participation in research projects
- access to supervision of theses
- access to databases

Each year DRUID welcomes a limited number of foreign Ph.D.-students who want to work on subjects and projects close to the core of the DRUID-research programme.

External projects

DRUID-members are involved in projects with external support. One major project which covers several of the elements of the research programme is DISKO; a comparative analysis of the Danish Innovation System; and there are several projects involving international co-operation within EU's 4th Framework Programme. DRUID is open to host other projects as far as they fall within its research profile. Special attention is given to the communication of research results from such projects to a wide set of social actors and policy makers.

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