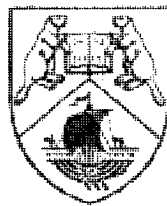


Modelling That Problem Set Which
Is Team Production

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1. Introduction.

In his Ely Lecture to the American Economic Association, Nicholas Georgescu-Roegen characterized Wicksteed's century-old production function (Wicksteed, 1894) – variants of it are still with us – $P = F(a, b, c, \dots)$ as a “paradigm of imprecision” (Georgescu-Roegen, 1970, p.1). What Georgescu meant by this was that such a production function fails to capture the “essential” concept of “process” (Georgescu-Roegen, *ibid.*, pp. 2-3).

But even if a production function does convey the idea of process, it will still remain a “paradigm of imprecision,” and necessarily so, wherever production inside a firm involves two or more persons grouped into a team. Actually, the “paradigm-of-imprecision” characterization should be taken even further. For the conventional production function, even if transformed in the manner suggested by Georgescu in order to represent a “process,” would still fail to provide a felicitous representation of the contribution to the productive process of the services of workers typically enmeshed in series of (largely implicit) contractual relations with their supervisors and employees, as well with each other.

Furthermore, Georgescu pointed out, there is a tendency simply to associate the concept process with “change” (Georgescu-Roegen, 1970, p.2, emphasis added). But change is a notoriously intricate notion. Georgescu believed that he could deal with these intricacies by making use of “grounded-in-actuality symbolism” (*ibid*, p.8). However, Georgescu’s grounded-in-actuality symbolism, as painstakingly meticulous in its attention to physical detail though it was, could scarcely add to one’s understanding of what will be a major concern of this paper: namely, an examination of a complex human input within a context of team production.

The object of this paper may be described as simply setting the stage for a look at this reality of team production, as well as bringing into view a relatively complex human input.

Section 2 of the paper deals with what we describe as a shift in focus in the literature of the theory of the firm and theory of production. If we may prejudge: this shift appears to be very wholesome. It is still with us, and can be brought under the generic label, “moving out of the black box” (cp. Jensen and Meckling, 1976, pp. 306-7).

Section 3 explores some of the principal problems of team production.

Section 4 deals with what we refer to as the problem of “signing” the Alchian-Demsetz cross partial derivative.

Section 5 offers a brief caveat concerning the paper’s objective and concerning, too, a simplifying assumption on team-member preferences.

Section 6 examines “incomplete” contracts.

Section 7 looks into the difficulties of specifying the utility function of a team member.

Section 8 offers the reader the opportunity to switch to what some people might consider to be a more user-friendly vocabulary and set of concepts.

Section 9 presents a “real-world” class of complex human inputs that are illustrative of what is actually the problem set of this paper – for which the preceding sections have really been more or less prolegomena.

Section 10 is a concluding note. Instead of being a “conclusion” in the conventional sense, it is a brief inquest into one of the unsettled issues and areas of discomfort left by the paper: namely, our simplifying assumption on team-member preferences.

2. The Shift in Focus.

Over the years, attempts to deal with matters alluded to in the Introduction have had the consequence, for the theory of production and the theory of the firm, of shifting the focus, in so far as human inputs are concerned, from dealing with these inputs in a physical sense, coupled with as assumed homogeneity of such inputs and what may generally be described as a static production-function world view, to the services of the human beings and the contractual arrangements – typically implicit – under which these services are employed.

3. Team Production: Defining Properties, and Modelling Difficulties.

Surely virtually all production in the plants of the textbooks as well as “out there” is team production. As was argued in the Introduction, there cannot really be said to exist in such a context a conventional, static production function, even one which has been refined in an attempt to capture the notion of “process.” So, that textbook exercise of assuming one factor or factors to be conceptually “fixed” and another factor “variable” in order to “compute” the marginal product attributable to the variable factor is scarcely a credible one. And, it is not the usual and rather rigid fixed/variable factor distinction which is the problem here. Rather, it is the failure to recognize the ubiquitousness of team production and, correspondingly, failure to treat as non-separable the relationship between outputs and those inputs of human services which are locked into teams. In brief, where X is output, and Y_i and Y_j are inputs of services provided by two different team members (employees), $\frac{\partial^2 X}{\partial Y_i \partial Y_j} \neq 0$. (Cf. Alchian and Demsetz, 1972. p. 779.)

The key set of phenomena where there is team production – “teamness” let us call it – casts a shadow of doubt upon the existence of the marginal product attributable to that input which is a human service. Various phenomena may be brought under the head, teamness, but for our purpose they reduce to only one of concern: namely, networking, which is seen here as the necessity of having to work with others, at various levels of the firm’s hierarchy, in order to perform. The problems that will normally be associated with the need to interact will obviously include imperfect information with respect to how a managerial performance will affect the quantity and quality of employee

performance (and perhaps vice-versa). Likewise, as regards employees, managers typically have imperfect information – sometimes virtually no information – about the effects of networking within the various peer groups upon the quantity and quality of individual contributions to the productive process (the Alchian-Demsetz cross partial again, but see, also, Levine, 1994).

4. Signing the Alchian-Demsetz Cross Partial.

We have already touched upon, approvingly, the Alchian-Demsetz reluctance, in their team-production example, to envisage a conventional production function that is separable, logically and empirically, into two functions, one having as an argument factor service Y_i and the other Y_j . Our brief description of that story ended with the cross partial, $\frac{\partial^2 X}{\partial Y_i \partial Y_j} \neq 0$.

But we must move beyond the limits of the problem outlined by Alchian-Demsetz, and broach the vexing question of whether or not it would ever be possible to sign their cross partial. Thus, in a particular production situation, does Y_i play a beneficial or detrimental role with respect to the overall productive effectiveness of the firm? It may not be possible to tell. That is, where i and j are two workers on the same rung of the hierarchical ladder, could it be that $\Delta Y_i \uparrow$ has the effect $\frac{\partial^2 X}{\partial Y_j} \downarrow$? More exactly, does an increment in some activity by i have a depressing effect upon the productivity of j , in which case $\frac{\partial^2 X}{\partial Y_i \partial Y_j} < 0$?

Now, let us leave the scenarios such as the previous one, in which the action takes place on the same rung of the hierarchical ladder, and consider instead a scenario in

which the action or interaction takes place across different rungs. Thus, think of the case where Y_i is a “monitoring” service provided by a supervisor, and Y_j the “productive” activity of a subordinate. It could be that, in this instance, $\frac{\partial^2 X}{\partial Y_i \partial_j} > 0$ – but not necessarily.

5. A Caveat

There is no intention in this paper to examine, or re-examine, the economic theory of teams in the manner, say, of Roy Radner (Radner, 1972) or of Marschak and Radner (Marschak and Radner, 1972). Furthermore, we shall not follow Radner in assuming that there are differences among team members as regards preferences, where “preference is understood (by Radner, at least) to comprise both tastes and beliefs,” (Radner, 1972, p. 189). Actually, in Radner’s account, this is simply a definition (a definition which we retain). Furthermore, in Radner’s treatment (Radner on “Teams” in McGuire & Radner, Decision & Organization, 1972), the following appears as a “fact”: “in some cases the members of the [team] may have nearly identical preferences.” (Radner, ibid) Whether the latter is fact or assumption, in this paper it is an assumption.

6. Incomplete Contracts.

The problem of signing the Alchian-Demsetz cross partial can be compounded when one introduces the notion of “incomplete” contracts. That is, as Radner has pointed out (Radner, 1996, p.1361), even in the case of explicit contracts there can be situations in which many contingencies are not covered by the terms of the contract.¹

Obviously, this can introduce additional uncertainty as to how exactly team member i 's performance will affect the performance of team member j . In a word, one must deal with probable outcomes, not outcomes, here.

To go beyond Radner: presumably a comparable set of problems may arise in the case of implicit contracts, where, after all, many contingencies may be said to be untouched by the “intended” and/or “understood” conditions of the implicit contract. And, once again, one is forced to deal with uncertainty and probable outcomes.

7. Specifying the Utility Function of a Team Member.

Attempts to specify the (ordinal) utility function of a team member will bring further difficulties to the task of modelling team production. The utility function of a team member will presumably have as its arguments not only the monetary component and the various non-monetary components of a team member's total emolument, but, also, the contents of the social milieu of the team member's workplace. Now, social milieu together with the non-monetary components of the employee's emolument can be intersecting sets of phenomena, in which case specification of a “crisp” utility function may be difficult, even if we retain our simplifying assumption of no differences among team members with respect to preferences. Would this, then, be a case of trying to specify a crisp function over a fuzzy (imprecise) domain? Yes, quite possibly – and this aside from the question just raised of intersecting sets – if the team member's social environment has become what it is in part because of the intrusion of the inherently imprecise or fuzzy aspects of teamness.

Given, then, a fuzzy decision space facing the team member, what can be said of the team member's ordinal utility function over the alternatives in this space; that is, over bundles of emolument packages and facets of the team member's social environment? More precisely, what may be said of the scope of the logical properties of the team members' preference relations over the alternatives they face? In other words, as in the neoclassical theory of consumer behaviour, may we say that in this context, too, the decision maker is able to discriminate perfectly among his/her objects of choice? But "classical" preference relations may break down where, as in the present context, the objects of choice are to be found among sets of phenomena comprising bundles of non-monetary emoluments and facets of an ill-defined social milieu. In short, the classical "binary logic" of the species, preference/non-preference, may well become inapplicable here.

We have implicitly dealt with the social milieu as being a source of utility or satisfaction. But some facets of this milieu may be sources of disutility. If so, then what will emerge as dominant in this haze?

Yet another problem: that of determining the net effect of the social milieu, including all the relationships that form part of this milieu, upon the overall productive effectiveness of the plant or firm – a problem that will not go away, even if we believe that we can solve the problem of signing the Alchian-Demsetz cross partial.

8. A Switch to a More User-friendly Vocabulary and Set of Concepts?

If one wishes to equip one's self here with what some might believe is a more

user-friendly vocabulary (and set of concepts), then one could abandon descriptions of how imprecision or fuzziness with respect to preference relations or anything else for that matter may affect one's efforts to model team production, and, instead, simply speak of uncertainty.

9. A (Hopefully) Clarifying Set of Examples.

“Team production” is to be regarded as the “mother” of the problems in this paper. The problem is provided by the following examples of a class of inputs of human services that are rather more complex and difficult to measure – and possibly even to identify – than those that are encountered in the standard literature. In the standard literature, inputs of employee services are usually implicitly assumed to be, and are indeed more often than not treated as, relatively indifferenced homogeneous lumps. In contrast, in the following instance a key employee input can be described as assimilating and comprehending information received, and then translating this assimilation/comprehension into action. Specific examples of employees who have to provide this type of input could include peer groups of either blue- or white-collar employees who have to undertake, while on the job, a certain amount of task-related reading, or, alternatively, have to listen to an oral presentation by an equipment manufacturer's representative. The white-collar employee could be a group of clerks in the credit department of a large department store; the blue-collar workers could be installers of home swimming pools.

Now, the assimilation/comprehension and translation into action of received

information (our example of a complex input) – and the linkage between this input and productive effectiveness – would obviously be a function of attributes of the individual worker providing this input. But, just as importantly, the linkage would be a function, in part, of what we have referred to as “teamness”, with networking, it will be recalled, featuring as a key element of teamness. In other words, although comprehension, etc., and effectiveness of effort, would clearly depend upon aptitudes of the individual worker, they would also depend upon the worker’s interaction with other workers in efforts to understand what is read or acquired in other ways. Notice that here not only the potential capriciousness of a particular kind of individual ability, but the potential for ambiguity with respect to teamness would make the consequences for productive effectiveness of the input in question (assimilation/comprehension of received information and the translation of these into action) a decidedly fuzzy or uncertain (take your choice) matter. Obviously, in these instances the inputs are more complex than what is usually assumed to be supplied in the way of mental-cum-physical effort in conventional models of the theory of the firm or production theory. To move outside the theory of the firm for a moment, consider what, if anything, distinguishes workers from horses in the von Neumann equilibrium-growth model. But, actually, to make this point, there is no need to move outside the (conventional) theory of the firm and theory of production. For not only is there a neglect, in the conventional theory, of the less obtrusive aspects of team production (i.e., teamness et al.), but the question might well be raised, how much difference is there, really, between those uncomplicated, theoretically identical, tangible lumps which are inputs of labour services in the von

Neumann equilibrium-growth model and the inputs of labour services in the standard models of the neo-classical theory of the firm and/or theory of production?

10. A Concluding Note

We have admittedly left a residue of unsettled issues and areas of discomfort. In this concluding note, we shall dredge up only one of these. How upset should one become concerning our decision to retain our simplifying assumption of the absence of differences among team members with respect to preferences? “Preference,” it will be recalled, was defined by Radner – and it was a definition we retained – to comprise both tastes and beliefs. So, in our account, preferences are assumed to be executed within the same set of tastes and beliefs across all team members. But this (heroic) assumption still leaves us with the vexing problem of the scope of the logical properties of a team member’s preference relations over alternatives, and especially with the problem of whether or not the team member will in fact be able to discriminate perfectly among the various objects of his/her choice, given the intrusion of those inherently imprecise or fuzzy aspects of team production, including “teamness”. Finally, notice that eliminating the simplifying assumption of uniformity of preferences (again, as these are defined by Radner) would still leave us with having to face the uncomfortable prospect that the classical “binary logic” of the species, preference/non-preference, may well be inapplicable in the present context.

An Afterword

The hallmark of “meccanno-set” economics is the provision of “solutions” to all problems, no matter how sticky these problems may be. In this paper, and fortunately, we trimmed our ambition. Consequently, a meccanno-set structure never emerged.

Footnote

¹ Wintrobe and Breton hit upon essentially the same problem with their observations on “the limitations of formal contracts” and the supply of “loosely defined sets of contractual services.” (Wintrobe and Breton, 1986, p.530.)

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