

The Programming Approach

Methodological considerations based on the contributions by Frisch,
Tinbergen and Leontief*

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It seems that research activity in the field of medium and long term planning could enjoy a certain reawakening in the next few years¹.

* This essay is published in a book in honor and memory of Federico Caffè, a dear friend and mentor, with the regret of missing the opportunity to persuade him about the disruptive effect for the ‘economics’ and also the ‘economic policy’ of the (epistemological) meaning of the concept of the ‘programming approach’.

The ‘programming approach’ foreseen and partially theorized by some economists like Frisch, Tinbergen, Leontief, began to challenge and contest the very cognitive foundation of economic analysis, if considered as a ‘positive’ science. However in this essay I will not enter into the epistemological debate of economic as a science [for which I suggest among meaningful contributions: Schoeffler (1955); Scriver (1959); Hutchison (1964); and Schackle (1973)]. I hope to develop this theme, in future works, after having dedicated my limited time to build usefully a sort of metadisciplinary methodology of planning (emancipating it from the traditional economic analysis). Thus this paper will be limited to illustrate the ‘programming approach’ (as considered by Frisch, Tinbergen and Leontief), like a *turning point* in the economic analysis and a necessary premise for the new meta-disciplinary approach.

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¹ Such activity has undergone in recent years - after a noteworthy impetus during the 1960s - an undoubted decline, on an international scale. Many factors, both technical-cultural and political, contributed to this decline; but it is not within the scope of this essay to analyze such factors. An indicative sign of the decline of research in the field of medium and long term planning is represented by the trend of activities developed by the European Economic Commission of the United Nations (and in particular by its permanent organ the ‘Senior Economic Advisors’ of which I have the honor to be member for several years), who until the mid-1970s constituted the point of world confluence of the greater part of this research (a selected list of the UN-EEC work is

Nevertheless it is my opinion that - in order to be well oriented - certain reflections and methodological considerations on the 'programming approach'² need to be introduced and - for the purposes of medium and long term decision making - correlated contributions of social, urban, and regional economic research must be well integrated into this approach.³

Such an approach in fact constitutes an important ridge of planning experiences, whose underestimation, or the unclear or incomplete awareness of which, has been the cause of a very poor utilization and management of planning studies in the medium and long term; and probably also of the lack of usefulness (and even harmfulness) of many studies of economics, sociology and regional science of a 'positive' character that have been applied to planning, and more broadly, to economic policy.

This paper is dedicated to discussing and defining the said 'programming approach', and to attempt to free it from some of its fallacious and misleading interpretations.

included in the bibliography: see UN-EEC 1967, 1968, 1970, 1971, 1975). The reawakening, mentioned above, of medium and long term planning is related foremost to the *national plans for the environment* put forward by several Western countries (see Archibugi, 1993), and more broadly, to an increased multi-disciplinary conscience, an expression of which was the 'first *World Conference on Planning Science* (Palermo, 1992) and the creation of an *International Academy for the Progress of Planning Studies* (born from this Conference), whose Honorary Presidents had accepted to be Jan Tinbergen and Wassily Leontief. (On the 'relaunch' of planning studies let me refer to my own work, Archibugi, 1992a).

² Here, I will summarize – as said – how Frisch, Tinbergen and Leontief have outlined the 'programming approach' concept in their most mature works, taking in account the fact that the state of knowledge of the three Authors contribution in such matter is remarkably low, if compared with the importance that they gave to this concept in the last period of their life (and notwithstanding their celebrity as first Nobel Prize winners in Economics). [On Frisch, however, see the recent collection of essays collected by S.Stroem (1998) for the Frisch's centennial symposium, among them two, more close to our subject by Malinvaud and by Hughes-Hallett, neglect any reference to the programming approach concept].

Ragnar Frisch had been the first to use this expression in a appropriate way: see for instance Frisch (1961), republished in Frisch (1976), p. 179 and following. [introducing in English a neologism very suitable and not ever very unusual in that language: see the item "*programmatically*" in "The Living Webster" defined as "...pertaining to or of the nature of a program;" or the adjective derived from the item of the verb "to program" defined as "make a program or definite plan of..."]. I have not been able to locate a work – that I have only seen mentioned – which even used in its title the word, 'programmatically approach,' but which I cannot obviously give any assessment (Rose, 1984).

³ Unfortunately it has not yet consolidated an international glossary for 'plan', 'program', or 'policy'. 'Programmatically' can be considered also synonymous with 'policy oriented' or 'decision oriented'. The author recently have proposed a neologism – 'planology' – in order to indicate the entirety of (scientific) treatments concerning planning, the entirety of the 'planning sciences.' The word is to me preferable, since it expresses very well the trans-disciplinary anxiety toward a sort of neo-discipline; the passage from the planning sciences to the planning science (see Archibugi 1992). In this essay, one could express therefore, with the adjective "planologic" the attribute pertaining to the method of planning, i.e. to the planning through technical-scientific methods. However, the assumption of the term, 'planologic', presupposes the complete acquisition of its meaning and of the concept of 'programming approach' which is the subject of this paper; thus it would be incorrect to give this term as granted before proceeding to its explanation, argumentation and recommendation.

We will consider and discuss three aspects of the approach which are often poorly applied and even misunderstood.

The first aspect concerns the difference - or, rather the multiple *differences* - between *planning* activities and *forecasting activities*, or more simply between *plans* and *forecasts*.

The second concerns the relationship between *positive* and *normative* analysis in decision-making processes, i.e. the *program-oriented* (or *planological*, as we prefer) component of the analyses.

The third aspect, finally, concerns the general concept, role and use of a *program-oriented frame of reference* (including its possible *alternative scenarios*).

These three aspects will be treated with ample reference to writings by authors such as Ragnar Frisch, Wassily Leontief and Jan Tinbergen who have often returned to the subject, and considered it a necessary 'prolegomena' to any policy-oriented approach.

Even I consider that the reference to this approach, on the subject, by these authors and some others⁴ is a *condition sine qua non* for a correct eventual relaunch of long term economic planning studies.

However in emphasizing these three aspects through which we define the 'programming approach' (Frisch characterized it as 'the true programming spirit'⁵), it would be impossible to avoid obligatory reference to the relations between these three aspects and the more usual and recurring themes of a 'rational' economic policy. This further aspect, therefore, will be the subject of a final summarizing section, after having dealt with the three basic aspects of the 'programming approach.'

1. Forecasting and Planning

For some decades now the principle has been established, in the most qualified scientific literature concerning methods of economic planning, that the methods and techniques of *planning* are very different in aims, meanings, procedures, approaches, and results from those of *forecasting*.⁶

In 1962 at the first meeting of the newly born "Asepelt" (*Association scientifique europeenne pour la prevision economique à moyen et à long term*), Ragnar Frisch felt the need (while introducing the Oslo Model, which he and the

⁴ And even of other authors that we deliberately don't wish to consider here, such as Karl Fox (1973) and Leif Johansen (1977-78); and – for other interesting aspects – Bruno de Finetti (1972) and Daniel Bell (1981) of whom we limit ourselves here to recall only their names and in the bibliographical references the more meaningful works where there are mentions of the programming approach.

⁵ As he was often accustomed to express himself: see for example Frisch (1961), republished in Frisch (1976, p. 185).

⁶ Unfortunately a less qualified but more widespread and hegemonous scientific literature, has not taken this principle – which corresponds in fact to a rule of the 'policy-oriented approach' – into due consideration. And this has constituted one of the factors (albeit probably not the most important one) of the crisis of credibility of planning studies, and thus its decline.

Institute of the University of Oslo under his direction, had been working on for years) to begin with some considerations on ‘types of economic forecasting and programming’. And he immediately clarified the differences in approaches.

Frisch called the first type the ‘*on-looker approach*’.⁷

The most primitive approach to medium and long term forecasting is a mechanical *trend extrapolation* for some specific variable which one may be interested in, or a mechanical trend extrapolation made separately for each of a number of variables.

Such a rough procedure may be of some use in very simple problems where accuracy is not essential and where the growth process of the phenomenon in question is conspicuously stable [...]

In most cases, however, a more refined approach is needed. One will attempt to extrapolate *simultaneously* several demographic or economic variables, tying them together in their mutual dependency through a more or less elaborate dynamic model. [...]

The essential point in forecasts of these sorts is that the future course of any one specific variable - or constant - considered will throw light on the course of the others. All of the variables and constants should therefore be considered simultaneously. The essential point in this connection is not whether a magnitude is assumed to be variable or constant in the future, but whether it is deemed necessary to include it in the model or not. [...]

In the forecasts many of the elements which mutually influence each other are not actually observed, but must be guessed at.

This leads logically to an analysis which does not yield one definite forecast but rather yields a number of alternative forecasts, each of them being derived from a specific combination of assumptions regarding the future course of some of the elements that are structurally tied together. [...] The most plausible forecasting alternatives will be those which correspond to alternative guesses at the basis elements in this set up. [...]

One feature which is common to all these analyses that aim at systematizing alternative guesses, is that the attitude of the analyst is simply that of the on-looker. He simply tries to guess at what will happen without making any systematic attempt at finding out what somebody - the Government or a private organization or a coalition of private organizations - ought to do if they want to influence the course of affairs. [Frisch, 1962, republished 1976, pp.87-90]⁸

In practice, Frisch observes elsewhere⁹, forecasting is much more widespread than planning. It is a very simple procedure:

⁷ More precise shall be to translate it as ‘the voyeur approach’...of which the metaphoric analogy should not be completely thrown out.

⁸ Frisch R., *Preface to the Oslo Channel Model: A Survey of Types of Economic Forecasting and Programming*, prepared for the volume already cited of Asepelt (1962), republished in Frisch 1976. From now on, if not otherwise indicated, all italics of quotations are originals of the respective authors.

⁹ Frish, R., *From Utopian Theory to Practical Application: The Case of Econometrics*, (lecture for the Nobel Prize ceremony, 1969, republished in Frisch, 1976).

You start by guessing at the probable growth rate of gross national product in future years. And from this guess you try to estimate by using input-output analyses, national accounts etc. what the development of the various production sectors, consumption etc. will be. This is unsatisfactory for at least three reasons: (I) The growth rate depends essentially on what decisions are made regarding the control of the economy. Guessing at the growth rate, therefore, implies a guess regarding the economic policy to be pursued in the years to come. (II) Even if the growth rate is given, it does not necessarily indicate what the development of the various sectors of production or consumption etc. will be. The economy has many more degrees of freedom than just one. (III) How can you assert that the growth rate guessed at is the optimal one? The growth rate is indeed not a datum but a consequence of an optimal solution, with all the intricacies connected with the determination of that optimum [Frisch, 1969, republ. 1976, pp. 26-27].

Frisch is not the only one who emphasizes the reasons why the planning approach would be preferable to merely forecasting. Jan Tinbergen,¹⁰ for example, considering both approaches faced with the problem of unknown quantities, finds the planning approach more controllable than the forecasting type.

On some previous occasions I defended the thesis that planning constitutes a better approach to the future than forecasting. In this context planning is characterized by setting targets for the future and considering the instruments to attain the targets as the unknowns of the planning problem. In contrast, forecasting will be understood to mean that the instruments of socio-economic policy are given and are not changed; here the target variables are the unknowns of the problem [Tinbergen, 1971a].

As is well known, the 'operational' relationship targets/instruments is at the basis of Tinbergen's decision modeling. Later on we will look at the widespread reservation (in particular shared by Frisch and Leontief) regarding the approach that fixes targets in general and in advance. But the further concern of fixing instruments without targets, is strongly contested. There is an amusing metaphor by Leontief on the subject:

Considering the great variety of ways and the extent to which the government now affects the operation of the economy of the United States, one of our lesser worries should be the lack of the accelerating, braking, or steering devices that could be used to guide it smoothly and securely along a chosen path. The real trouble is that, at present, not only does the government not know what road it wants to follow, it does not even have a map. To make things worse, one member of the crew in charge presses down the accelerator, another pumps the brake, a third turns the wheel, and a fourth sounds the horn.

¹⁰ Tinbergen J. *Two Approaches to the Future: Planning vs. Forecasting* [mimeo], 1971

Is that the way to reach one's destination safely? [Leontief, 1976a, p. 157].

Coming back to the theme of 'planning vs. forecasting,' in another very brief text¹¹ (1971b) Tinbergen expressed in a more explicit manner reservations with regard to long term forecasting.

Un nombre augmentant d'hommes de science a compris qu'une étude approfondie de l'avenir peut faire des contributions importantes au bien-être futur de l'humanité. C'est depuis longtemps qu'on a compris que "*gouverner, c'est prévoir*" afin d'éviter un certain nombre d'incohérences caractéristiques de l'improvisation. Aujourd'hui il s'agit uniquement de la question *comment* il faut étudier l'avenir. C'est ici qu'à l'heure actuelle l'unanimité n'a pas encore été atteinte. Tout d'abord il y a déjà deux types de recherches dont les produits peuvent être appelés, respectivement, des prévisions et des plans. Les prévisions ont en commun qu'elles se basent sur l'hypothèse d'aucun changement de régime, c. à d. que les moyens de la politique socio-économique ne se changeront pas. Les plans sont caractérisés comme le meilleur développement parmi les alternatives possibles. [...] Notre première thèse sera que pour des périodes prolongées, disons couvrant plus de cinq années, *les prévisions ne possèdent qu'une utilité fort restreinte*. Cette restriction réside dans la nature même des prévisions. L'hypothèse d'aucun changement de régime peut être utile pour des périodes de quelques mois ou quelques années, mais elle ne se justifie pas pour les périodes qui nous intéressent [...]. Un autre inconvénient s'ajoute: celui de la faiblesse de nos connaissances des mécanismes socio-économiques à longue échéance. En général il est beaucoup plus simple d'identifier les forces opérant à décalage restreint que de déterminer les forces dont les effets ne se montrent que progressivement, une circonstance qui souvent nous empêche de discerner les effets des

multiplés influences déterminant les mouvements des variables socio-économiques - pour ne pas parler même de variables psychologiques, culturelles, etc.

Par conséquent l'étude de l'avenir à l'aide de plans au lieu des prévisions s'impose, quelque difficile qu'elle soit en elle-même. En d'autres termes, nous sommes forcés de nous rendre compte, comme composante essentielle de nos recherches sur l'avenir, des changements de régime nécessaires [...]. Au moins une catégorie de structures les chiffres principaux d'un plan seront moins imprécises que ceux d'une prévision [...] [Tinbergen, 1971b].

On this point Leontief too is very clear¹²:

A plan is not a forecast. The whole idea of planning assumes the possibility of choice among alternative feasible scenarios. Feasibility is the key word. [...]

¹¹ Tinbergen J., *Comme faut-il étudier l'avenir?* [mimeo], 1971, pp. 1-2.

¹² Leontief, W., *National Economic Planning: Methods and Problems*, (1976), reprinted in *Essays in Economics, Theories, Facts, and Policies*, Blackwell, Oxford, 1977.

Choice among alternative scenarios is the clue to rational national economic planning rather than crystal-ball gazing that, with the rise of general uncertainty, became a marketable product of the economic forecasting industry. [Leontief, 1976a, p.151].

It is a difference that, in principle, may be considered obvious: whilst forecasting tries to anticipate the future organization of an economic system resulting from its undisturbed advance, produced by the interaction between constants and variables which the analyst will try and guess, planning, on the other hand, fixes in the future the desirable organization of such an economic system and searches for which modifying interventions will be necessary to bring the system from condition A (the status quo) to condition B (that desired).

In short, the differences between planning and forecasting, as different approaches to the future, concern above all the following four points:

1. the admission or not of changes in what Tinbergen calls the 'regime' of the economy;
2. the management of the 'uncertainty' component, or the instrumental nature (in planning) or substantial one (in forecasting) of unknowns;
3. the presence/absence of a search for optimality;
4. the degrees of liberty (number of possible future alternatives) recognized in the system in its evolution.¹³

2. Decision-Making Analysis in the Programming Approach

Frisch says¹⁴: 'When the emphasis is shifted towards the viewpoint of influencing the course of affairs, the analytical framework changes. Now we will be seduced by certain elements – either variables or constants – of specific interest, particularly that which can be established in a rather direct way, freely, at least within certain limits. They can be called *action parameters, instruments, or decisional elements*' .

2.1 Three stages of decisional analysis

In the march toward decisional analysis, however, Frisch identifies no less than three stages.

The first stage (that *ad hoc instrument*) constitutes a primitive version of the type of decision approach. It encompasses only one or a few relations which connect some variables that people desire to see evolve in a certain way, together

¹³ For a deeper definition of the concepts of "projection", "forecast", and "plan", see Johansen, 1977-78, vol. 1, pp.125-126. He adds two specific concepts: that of "conditional forecast" and of "indicative forecast", which even if interesting add very little to the type of critical consideration here developed on the net distinction among the two approaches. Further development on the subject in Theil, 1961 and 1964.

¹⁴ Frisch, 1962, pp.90-91.

with some other variables that seem to be susceptible to direct control, at least in a certain measure. But the inadequacy of such an approach appeared obvious to Frisch:

In this analysis one is not even able to indicate which combinations of instrument fixations are in fact feasible from the viewpoint of the totality of all the realistically relevant relations that prevail in the economy. Before an analytical tool for describing this feasibility is available, no practically useful results can be produced. An ad hoc and haphazard fixation now of one instrument now of another – each time with some specific target in view – may indeed lead to quite unexpected, even chaotic, results, producing extreme tensions and contradictions in the economic structure. An ad hoc instrument approach to forecasting and programming is, therefore, warranted only as a very first and tentative preparation for a further analysis that does lead to a precise dynamic model with a well defined number of degrees of freedom [Frisch, 1962, reprinted 1976, p.90].

Whilst the ad hoc instrumental stage is not based on a consistent model, the second stage of the decisional analysis (that ‘feasible’) uses a consistent model. This, however, can be present also in the forms ‘more sophisticated of the on-looker approach’, with the difference that in the case of the decisional approach we will research as a foundation the greatest number of elements that can play the role of *instruments*. Here, however, logical problems are met which compromise strongly the validity of the models called “decisional” built in such a way. The ‘*half-logic*’ – as Frisch called it – of this approach, which is that of prevailing in the model-building applied to economic policy, is far to be perceived, and it is that which makes unreliable a good deal of the modern techniques, apparently scientific, applied to the economic decision; and render the econometrics applied to the economic policy a dangerous and treacherous terrain, and largely fallible. Anyhow, it is false programming. Let’s follow Frisch in his insuperable reasoning:

As a rule one will not be able to find a sufficient number of instruments to cover all the degrees of freedom in the model. This means that one or more *exogenous* elements will have to be left in the basis set. And the time evolution of these exogenous elements will have to be guessed at. For each such guess one may consider several alternative fixations of the decisional elements, each such fixation leading to a well defined forecast for the evolution of all the variables considered. In this way one will be able to systematize the possible alternative projections which it is worthwhile to consider in a study of ways and means to influence the course of affairs [*ibidem*, p.91].

After recalling that if the problem is coded for an automatic computer in such a way that the assumptions about the exogenous and decisional elements can easily be changed, it will be a simple matter to ‘run’ a whole series of alternative projections (and one will be able to play national economic simulation games

much in the same way as the military strategists play battles and even wars on the electronic computer); and after having recognized that ‘the shift from the on-looker viewpoint to the decision viewpoint has become more and more prevalent in economic thinking’, however, Frisch observes that ‘this shift in viewpoint is, however, based on a sort of half-logic which I have never been able to understand and which, I think, will never be able to yield fundamental solutions.’¹⁵

On one hand one still retains the on-looker viewpoint, and tries to make projections on this basis (growth models of the current types). And on the other hand one will afterwards try to use such projections as a basis for decisions. How can it be possible to make a projection without knowing the decisions that will basically influence the course of affairs? It is as if the policy maker would say to the economic expert: ‘Now you, expert, try to guess what I am going to do, and make your estimate accordingly. On the basis of the factual information I, thus, receive I will then decide what to do.’ The shift from the on-looker viewpoint to the decision viewpoint must be founded on a much more coherent form of logic. It must be based on a decision model, i.e. a model where the possible decisions are built in explicitly as essential variables.

With his usual simplicity and efficacy Frisch here puts his finger on the sore point of a ‘conventional’ way of approaching the problems and practices of planning, which is as fallacious as it is widespread.

All the uses of current modeling (thus the better part of studies and research in econometrics and also in planning up to now) have the serious handicap of being constructed on this ‘half logic’; and thus the correct ‘programming’ or ‘planological’ approach is not respected.

2.2 The fallacious result of the ‘pre-programming’ approach

Frisch often insists on the subject of the crucial distinctive character of the ‘programming approach’ with respect to what he called, “examples of what I would call *pre-programming way of thinking*.”¹⁶

First let me mention the great emphasis that is often put on such a concept as savings rate, i.e. the part of private income that is not used for consumption. Frequently one tries to estimate this rate on the basis of past data and *before* the decision on investment and other decisions on economic policy are taken, and then, afterwards to use this estimate of the savings rate as a basis for decisions on investment and on the other aspects of the economy. This way of proceeding is to put the cart before the horse. The savings rate is not a datum for economic policy decisions in a true programming sense, but it is itself a consequence – one might almost say an incidental consequence – of the programming decisions. In a developing country where it is the explicit

¹⁵ Frisch, 1962, reprinted 1976, pp.91-92.

¹⁶ Frisch, 1961, reprinted in 1976, p.183.

purpose of the authorities to change the past course of affairs and transform the economy from a stagnant one into a truly progressive one, it has little meaning to estimate *a priori* the savings rate by means of data that have emerged under a different economic policy and perhaps different economic institutions. The data from which to start in a true programming analysis must go much deeper down into the technological and behavioristic structure of the economy. For this reason I have always been rather sceptical about the usefulness of such an extremely simple analytical tool as the Harrod-Domar growth model. Models of this type may have a certain descriptive value when applied to an economy that is left more or less to itself under a regime of a rather free market economy, although even for this purpose they are too aggregate to have much explicative power. A growth model with sectorial breakdowns and other refinements which give it much more explicative power has recently been given to us by Mr. Leif Johansen who is participating in this seminar. But even his model is more in the nature of a specific growth model and does not have the features which I think essential in a true programming analysis.

In this connection should be mentioned also another special type of fallacy which is frequently encountered in economic planning work, namely to put as a target a more or less arbitrary rate of development of national income, and then try to find out what consequences can be deduced from such an assumption. Such a starting point for the analysis has no logical basis and owes its popularity, I think, only to its simplicity. (To introduce the national income development rate in the preference function is an entirely different matter. In this case optimum calculations are made.)

This is the crux of the matter raised by us, of the correct programming approach. It is its core. On this point, of the programming approach character of planning, it is worthwhile insisting on some essential observations.

The overcoming of the half logic on which the criticism of Frisch has been concentrated regarding the approaches of contemporary econometrics,¹⁷ induced a more 'negotial', more 'institutional', and more 'evolutionist' vision of the theory of economic policy itself.

This is the reason why, in Frisch's opinion, a basic aspect of a more rational approach to the study of the feasible instrumental choices, is the need of continuous cooperation among the decision makers – governmental or private – with the analysis experts. However it is a matter of cooperation based on an amount of studies, elaborations, and evaluations through which the planning moves away from the economic theorems which are normally at the foundation of

¹⁷ Frisch, at the first World Congress of the *Econometrics Society*, held in Rome in 1965, (which I remember well, having been its General Secretary) warned against the risk of 'playometrics' to the numerous convened (with the authority of having been the most illustrious founder of that Society). The mathematician, Bruno De Finetti translated, enthusiastically, the sarcastic term of Frisch in Italian as "baloccometria" in a sapid essay on the Congress proceedings, 'Econometristi allo spettroscopio' [Econometricians through the Spectroscope] (see De Finetti, 1969, pp.174-188). Frisch returned to the concept of risk of *playometrics* in a paper: "Econometrics in the World of Today", included in a volume of essays in honor of Sir Roy Harrod (Eltis, Scott and Wolfe, eds., *Induction: Growth and Trade*, 1970).

economics, and put their roots on a modelization based on a wide field of highly disaggregate detailed data, and evident parameters of relationship between exogenous variables and instrumental variables.

However when – with the continuous cooperation of the analyst and decision maker – the effort to map a range of feasible alternatives has been deeply and widely developed, then the conclusion will be inevitable to the public and the authorities, according to Frisch, that the number of feasible alternatives is so big that it will be impossible to keep track of them simply through their list and description. And then will be evident the necessity of an analytical technique to encompass that – or those – alternatives to be considered in a certain way optimal. In this consists the third stage of the programming approach: the ‘true’, methodologically valid programming approach.

The first and second stages, in fact, should be considered as progressive steps towards this. Otherwise, by themselves, they can constitute special dangers, they can be misleading, sometimes worse than their absence.

This leads directly to the problem of *mathematical programming* applied to economics. Not only to economic programming in individual enterprises, but to economic programming regarding measures to be taken in the economic system at large. We need mathematical optimization at the national – or even international level (ibidem, p.93).

On two critical aspects, on the other hand strictly interrelated, the question of a authentic *programming approach* finds its qualification in the debate of contemporary economic policy: a) on the model’s quality; b) on the function of the political preference.

2.3 The Decision Model

On the first aspect, Frisch insists mainly on the distinction between *decision models* and *growth models*. On the importance of that distinction he states very clearly.

The distinction between what is essentially a *growth* model and a *decision* model is important. When I speak of a growth model, I am *not*¹⁸ referring particularly to its dynamic character, because a useful decision model is also essentially dynamic, but I think of the rather too passive attitude to economic growth which is displayed in the use of the Western type of growth model approach, characterized by such simple notions as the general savings rate, capital to output ratios, marginal productivity of capital, etc. without explicit introduction of the *decisional parameters* that will basically influence growth. The explicit introduction of these parameters in an operational way is what characterizes a decision model...[Frisch, 1962, reprinted 1976, p.101].

¹⁸ Italics mine; the others are by Frisch.

The second observation concerns an elementary relation, that between *decision models* and *common sense*. Even in this case, Frisch's considerations illustrate the point clearly and concisely.

A realistically constructed decision model is nothing more than systematized common sense. No sensible decision model builder believes that he can embrace everything and in an exact way. But he does know that it is possible through aggregations and approximations and simplifying assumptions to say something useful about a lot of things that are *relevant* and *too numerous* and related in *too complicated* ways to be grasped by simply talking. Through the models he will be able to build a useful plan-frame. Or several plan-frames – one on each aspiration level in hierarchy of problems.

To a large extent effective programming is an *art*, not a science [*ibidem*, p.102].

2.4 The Function of Political Preference

On the other relevant aspect of the new programming approach, that of the *political preference function*, Frisch argues that the *formalization of the preference function* must be subject to the same concept of the *optimal* economic policy; and can be considered the basis for a new cooperation between politicians and economists.¹⁹

¹⁹ The argument of the political preference function normally raises also the question of the political organization in which the planning process is implemented. More than once, Frisch has been obliged, if you like, to point out that, 'in the Western kind of democracy the preference function cannot and should not be formulated *by dictate from above*'; and that, 'all layers of the population should participate in shaping its final form'. He believes this feasible through the formulation by all political parties and different organizations engaged in the economic questions – in cooperation with the analyst – 'the particular preference function they want to suggest (and the particular extra conditions they want to impose on the program).' According to Frisch, 'the optimal solution for economic policy measures which emerges from such a setting of the problem, should be computed by the expert. And it should be published and *made the object of a public debate*' (Frisch, 1962, reprinted 1976, pp.94-95).

The political organizational aspect of the preference function, and more generally of the whole planning process (of which the preference function is the core) is often dealt with by Frisch, considering it an essential condition for the development of economic planning. He is clearly in favor of a negotiated programming which is outlined in this way: 'Even if we did not go any further with the formalization of the system of preferences than to work out such an analysis *separately for each political party*, an enormous gain would be obtained in elucidating the economic political discussion.' But we should not stop at this point. We should proceed to a discussion of what sort of *political compromise* might be reached in the formulation of an unified system of preferences. And then, having reached this compromise formulation, there would appear a compromise optimal solution. Here too, an iteration between politicians and experts would take place. 'The top political authority – in a democratic country it would be the elected parliament – ought to concentrate *most of its time and efforts* on a discussion of this compromise on the formulation of the system of preferences, instead of using practically all of its time on discussing one by one the specific economic measures that might have been proposed, and for each of these measures deciding whether to accept it or not.' (Frisch, 1969, reprinted 1976, p.30)

Another misunderstanding that Frisch wished to put in evidence concerns the objection of many that 'there are *many different* systems of preference.' And that, therefore, 'the concept of

The preference function cannot be formulated in one stroke. It can only be done through a series of attempts based on continuous cooperation between the responsible authorities and the analytical experts. A series of tentative solutions with different alternative formulations of the preference function (and of some of the bounds in the problem and other side conditions) is needed. In a sense we are thus back again to a study of alternatives, but they are now alternatives on a higher level in the hierarchy of analytical techniques (*ibidem*, p.94).

For the construction of the preference function, Frisch suggests three phases.

A preparatory phase of the expert's work on the preference function would simply consist in his making a systematic use of his general knowledge of the political atmosphere in the country, and in particular the political atmosphere in the party in question to which a constructed preference function would apply. The expert will have formed an opinion, a *tentative opinion*, about what the preferences of this party would look like if they were formalized in a way that fits in with the expert's model, and is expressed in a language understandable to his electronic computer.

In a subsequent phase the expert – on the basis of this tentative formalization – will work out a system of interview questions by which he will get *closer* to the formalization of the preferences in question.

It is well known that people will not always behave in a given situation exactly

preference function cannot be used in connection with national models.' On this point Frisch is quite radical: 'This is one of the biggest pitfalls in the discussion of this matter. Of course, there are differences of opinion. One social group may have one type of preference, and another social group may have other preferences, and different persons may have different preferences, and even the same person may have different preferences at different points of time. All this is, of course, true. But the problem of settling differences of opinion *is not a special problem of econometrics*. It is a general problem of human behavior and opinions. And there exists a machinery for settling such differences. This machinery is simply the political system of the country. This political system – whatever it may be – has been created for the very purpose of settling such differences. What we have to do as econometricians is to apply this very system for the *formalization* of the preferences to go with our models. Thus the preference function as it appears in our model is an expression of the preferences of the decision making authority, whatever that authority may be. The preference function in the model must not be confused with a general "welfare function" in the sense of welfare theory'.

'It is not our task as econometricians and social engineers – says again Frisch - to go into a detailed discussion of the political system. Somewhere in the hierarchy of sciences a line of demarcation has to be drawn. And here is where we find the line of demarcation for the econometric planner. As *citizens* we are, of course, allowed to work for any political system we think is just and effective. I, for one, would like to work for a system that really deserves the name democracy, but that is another story' (Frisch, 1970a, reprinted 1976, pp.42-43).

We have referred in this footnote to these visions of Frisch in connection to the function of political preference because they are – so to speak – 'tangential' to the methodological and epistemological questions of the programming approach, which constitute, on the contrary, the specific subject of this paper.

in the way they *said* in an interview question that they *would* behave in such and such a situation. But still, I think, it remains that valuable information may be obtained by means of interview questions, provided the questions are wisely formulated in a *conversational manner*, and not simply carried out by some youngster in the opinion poll trade. I have worked out a rather elaborate technique for such conversational interviews to be carried out by econometric experts. And I have had the good fortune of testing this out in conversations with high ranking politicians both in developing countries and in industrially developed countries. I have found that it is surprising how far one can get in this field when the conversation is wisely steered.

Essential points in this connection are: 1) To use the free form – the ‘Santa Claus’ form²⁰ – of the preference function; 2) To ensure that the interviewed person rids his mind completely of any preconceived (and in many cases erroneous) ideas he might have on the nature of the core, and thus disregards whether it is actually possible to *realize* the alternatives involved in the interview questions; 3) To sure that the interviewed person has rid his mind completely of any possibility of trading in the market any of the alternative situations which are hypothetically offered to him in the interview questions. This is the *earmarking principle*²¹....

In a third phase, the expert will go back to his electronic computer in which he had already entered the data regarding the core of the economy. To this he will now add the formalization of the preferences in the quantitative form as he now sees it. This will give him a solution, in the form of an optimal development course of the economy. Optimality being defined through the preferences of this party, and in the preference formalization which the expert has *now* reached [Frisch, 1971, reprinted 1976, pp.45-46].

Therefore, for Frisch the ‘optimality’ is achieved through the dialogue between the decision maker and the analyst.²² Because the decision maker expresses himself in different successive phases of major adherence to the *objectives* (of which he is the legitimate bearer and formulator), given the existing *constraints*

²⁰ Many times Frisch intended by a ‘question in the Santa Claus spirit’ a question to the politician of this kind: ‘which one of some specified few alternatives would you choose if you had the choice?’

²¹ In this way Frisch named the procedure of collecting, identifying and isolating the more simple and pure possible political evaluations, before submitting them to the econometric analysis of the preference function.

²² He identified always this analyst in the economist, and more precisely in the econometrician. For myself I prefer to make even more ‘neutral’ – from the disciplinary point of view – the role of the expert, in consideration of the needed neo-disciplinarity in the field of planning (for this see Archibugi, 1992b), which come just from the role that in the economic analysis will play the ‘programming approach’. In my vision, however, there is an abstract division between the role of the politician and the expert (‘planologist’) of the planning process (even if sometime the boundaries and also the roles are not so well defined), and it is opportune to call them ‘decision maker’ and ‘analyst’. Both are ‘planners’, but with different roles: one is a political subject who plans and chooses in the name of a community (a ‘planner decision maker’); the other is a professional subject, who does not ever choose, but displays accounting frames and scenarios on which the planner decision maker chooses and decides (‘planning expert’ or ‘planologist’).

(of which the analyst is the unique expert connoisseur, and therefore the legitimate bearer and formulator). The tradeoff between objectives and constraints occurs, concretely, always in preference schemes to which one arrives *a posteriori* of the analysis, whatever be the preference scheme which could be formulated *ex ante* ('Santa Claus' form) by the decision maker, without a sufficient knowledge of the constraints. Frisch recommends that this knowledge of constraints, if existing, should completely be forgotten by the decision maker, canceled by his mind, so as not to pollute with prejudice the "pure" decision process managed in cooperation with the expert.

When we now approach the construction of the preference function we must therefore free our mind completely of the idea of target setting. We must approach the problem in the 'Santa Claus' spirit. The type of interview questions to be put to the policy maker in order to obtain the data necessary to construct his preference function is: 'Would you have this or would rather have that *if you had a free choice?*'

...On the whole there is a need for continuous cooperation between the responsible policy maker and the analytical expert. The success of scientific planning at the macroeconomic level depends to a considerable extent on such a continuous cooperation and its taking place in an atmosphere of mutual confidence....

But this being said, it should be clearly recognized that the scientific experts are not to *decide* anything. They are to furnish the responsible policy makers with all the information and clarification which they are able to give. But the final responsibility for *decision* must rest with the political authority. [Frisch, 1963, reprinted in Frisch, 1976, pp. 158-159]

The idea 'to free our mind completely of the idea of target setting' (to use Frisch's phrase) represents another basic character of the programming approach.

The programming approach, in fact, consists in 'starting' from a programming analysis, i.e., an analysis oriented to the objective or programs, of the factual situations. But the objective system must be extracted from the entirety of objective tradeoffs that a comprehensive frame of the needs and opportunities (ends and means) can furnish.

With respect to this approach, Leontief uses a very clever example:

The important practical difference in making a choice between alternative national economic plans and selecting an appropriate set of national goals can best be explained by the following example: A friend invites me for dinner in a first-class restaurant and asks that I supply him with a general description of my tastes so that he can order the food in advance. Unable to describe my - or anyone else's - tastes in general terms, I prefer to see the menu and then select, without hesitation, the combination of dishes I like.

Confronted with alternative national economic plans - each described in great detail, particularly with respect to items that are likely to affect my own well-being and my personal assessment of equity and fairness of the whole - I

would have no difficulty in deciding which of them I would prefer or, at least, consider not inferior to any other. I could do this, despite my inability to describe my preferences, my predilections, and my prejudices in general terms. A philosopher, a social psychologist, or a historian might succeed in arriving at such generalisations, but by inference based on an interpretation of my utterances or, even better, of specific choices I have actually made before. But this, of course, is an entirely different matter.

This, I submit, is the reason why a planning process should not start out with the formulation of what theoretical economists refer to as the general 'objective function,' but with elaboration of alternative scenarios each presenting in concrete, non-technical terms one of the several possible future states of the economy.²³

...To repeat. Public discussion and democratic choice among the available alternatives will be possible only if each of them is presented in concrete tangible details rather than in such summary terms as the per capita GNP, the average rate of unemployment, or the annual rate of growth of the 'implicit price deflator.'²⁴

But within the *preference function* is nestled the most misleading misunderstanding concerning the use of economics – and particularly this peculiar kind of economics called econometrics – as science supporting decision making or programming.

Synthesizing the different typologies of econometric models (at national level), Frisch summarizes also the way in which a problem can be managed. He called

²³ Here Leontief had a consideration which, without deserving to be omitted from our purely methodological quotation, deserves however to be recalled because its high conceptual meaning: 'Karl Marx would have rejected this as a utopian approach and so do the libertarian opponents of national economic planning. Both view the concrete shape of the unknown future as unfolding itself while time marches on. The only difference between these believers in the "invisible hand" is that the latter are ready to accept and approve whatever might come, provided it has not been planned, while the former is convinced that, while unpredictable in all its details, the path inevitably leads to violent collapse of the present social and economic order' (ibidem, pp. 153-154)

²⁴ Leontief, 1976, op. cit, p. 154. It is difficult not to catch here the subtle irony of Leontief in using the name of most used variables in the current econometric models, and on which are still founded most of the endless reasoning and evaluation choices of current economic policy (even when they are not supported by model apparatus with their scientific appearance). And perhaps it is also superfluous to note that, behind these names evoked for example, there are the most important aggregates of the national economic accounting (investments, savings, consumption, wages, profits, employment, unemployment, inflation, industrialization, foreign accounting, and whatever else might be thrown in). Leontief's irony is applied therefore, to the use, in current economic policy, of these aggregates when they are objects of evaluations and choices *per se*, and when they are not intended just in their mere quality of 'aggregates', i.e. of totals of completely different component structures on which it would be opportune to switch the decision makers' evaluation choice. Such a decision maker evaluation choice should be brought on those menus or scenarios ('presenting in concrete...possible future states of the economy') of which Leontief was speaking. And one should leave to the consideration those aggregates only to the structural analysis of consistency (and of feasibility, as Leontief says) which they can allow, and which are at the foundation of the menus and scenarios on which to choose.

the “core” of a model a list of variables and equations and/or constraints that are introduced (whether of linear or non-linear type is unimportant). He adds

In addition to the core one may or may not introduce a preference function, that is a function whose maximization defines the goal of the decisions that might be studied through the model. With a preference function it becomes possible to say that one alternative constellation of the values of the set of variables is *better* than another and it might even be possible to proceed to determining an optimal solution. Otherwise the model is only a *purely descriptive one*, that can be used to produce a sample of alternative constellations, or to answer questions of the type: “What will happen if...” [Frisch, 1969, reprinted 1976, p. 22]

After having recalled the other usual possible characteristics of any model,²⁵ Frisch liked to emphasize:

A common misunderstanding regarding the preference function is due to a failure to distinguish between *targets* (i.e. specific values of some selected variables) which one will try to *realize*, and the use of a *preference function*, and also due to a failure to distinguish between the free and the reduced form of the preference function.²⁶ It is said that the decision maker at the national level (the responsible political authority) is not able to understand the meaning of the core. Therefore he cannot formulate targets or define a preference function.

These objections vanish if the expert approaches the decision maker in the appropriate way....[ibidem, p.22]

Frisch, therefore, recommended always as already said, in order to realize an appropriate programming approach, that a right relation between expert and decision maker should be established, well fixing the properties and limits of the respective roles.

3. **On the General Conception of the Plan Frame of Reference as a Decision-Making Instrument**

The programming approach is configured not only as that which undertakes the

²⁵ For instance to be ‘static’ or ‘dynamic’ (according to whether connects variables that are of the same point of time or of different points of time); or to be deterministic or stochastic; all alternatives which don’t concern the present subject.

²⁶ The ‘free form’ is defined by Frisch also as the ‘gross form’, or – as said – the ‘Santa Claus’ form: ‘which one of some specified few alternatives would you choose, if you had the choice?’ It is not important, according to Frisch, to understand the core in order to answer such questions. The reduced form of the preference function is only understandable for Frisch ‘only in terms of the core: in terms of a set of variables equal in number to the number of degrees of freedom of the core. Mathematically speaking several reduced forms might (and in general will) exist. The choice of one particular reduced form is a practical question.’ (1969, reprinted 1976, p. 21)

analysis of phenomena and behavior in a way that is ‘decision-oriented’, but as that which founds this decision on an overall ‘systemic’ vision of the various problems in play, by means of the construction of a scenario (or several scenarios) on which the problematic horizons of the decisions themselves may be widened for the sake of configuring compatible decisions.

In such a way the construction of scenarios and plan frames of reference becomes a preliminary and prejudicial component of the programming approach.²⁷

And again in the same essay quoted above, there are other basic observations by Leontief that are useful for tracing in general terms how the *plan frame of reference* must be considered.

3.1 Temporal flexibility

In its published form a national economic plan, or rather the statistical appendix to its text, can be visualised as a detailed, systematic annual survey of manufacture and agriculture, of transportation, and of trade and the federal and local budgets. However, it describes the state of the economy not for a given past year [...] but rather for five years in advance and, in a more summary form, for a much longer interval of time stretching into the future. This does not mean that a plan must be rigidly adhered to over the entire period of, say, four or five years. On the contrary, the plan should be revised each year in the light of past experience and newly acquired information and pushed out as a moving average one year ahead. [W.Leontief, *op. cit.*, 1976 pp. 150-151].

This concept of the ‘moving average’ was frequently emphasized by Frisch as well (*op. cit.*, 1976, p. 118):

This simply means that each year we work out a new dynamic optimum decision analysis for the planning horizon (say five or seven years) which is adopted, taking account, of whatever fresh information has become available. This means inter alia that in the plan which is worked out in any given year, we have to include in the set of non decisional elements (i.e. in the set of already-committed elements) those things that were decided upon in the analysis of the preceding year.

And in a following passage (*op. cit.*, 1976, p. 135):

It is customary to speak of, say, a one year plan, a five or seven year plan, a

²⁷ The use of the word *scenario* is present in Leontief and in Tinbergen; but is absent in Frisch, who preferred words such as *plan frame*, *configuration*, or *constellation*. None of these authors has proposed a more precise lexicon, in order to facilitate communication; even because none of them engaged himself in an explicit didactic work. For more detail on the building of ‘reference plan frames’ or more simply ‘programmatically scenarios’, let me refer to a methodological report by myself, for the construction of a ‘programmatically plan- frame’ for economic planning in Italy, on the occasion of the engagement for the preparatory works for the Italian Plan 1971-1975, which the presiding government tried to produce (see Archibugi, 1972).

twenty year plan, and so on. This kind of division is a practical necessity because many concrete aspects of the work must be different according to the length of the time horizon.

But this practical necessity must not lead to the idea that a plan of a given time length - say a five year plan - is something that is to be worked out at a given date and then to be petrified and stuck to for the coming five years, regardless of what is going to happen in the course of these five years. This would be a dangerously naive procedure.

In a dynamic and living world the planning work must be flexible enough to absorb and utilize all the new information that is constantly pouring in. And it must also be flexible enough to take account of changes that might occur in the policy makers' desiderata. For many years I have advocated the view that the only rational way to introduce this sorely needed flexibility, is to put the whole planning work on a *moving* basis.

Frisch often uses the phrase '*moving*' or '*sequential planning*'.

3.2 The necessary threshold of disaggregation

Leontief talks of the 'plan' as a review of programmatic data oriented to the future. But these programmatic data become a plan when they have been selected from the many possible scenarios by a decision-making authority. While these are programming data in that they have been worked out on the basis of hypothesis-objectives and decision-making criteria, without having received the sanction of the political authority, it should be more opportune to talk about a *programmatic 'frame' of reference* than a *plan*.²⁸

Regarding the useful concept of a plan 'frame', the recurrent recommendation is that of ensuring the maximum possible disaggregation. Such a recommendation starts from the belief that traditional economic policy, founded essentially on fiscal and monetary policies, is incapable of constituting a valid instrument of policy and decision. Leontief says:

Conventional monetary and fiscal policies relying on a rather sketchy aggregative description and analysis of the economic system appear to be no more successful in compensating for the lack of systematic foresight than frantic pushing and pulling of the choke is able to correct the malfunctioning of a motor. Occasionally, it works, but usually it does not. [*ibidem*, pp. 151-152].

Although Leontief himself acknowledges that all the systematic information cannot be included in an economic plan, he nevertheless insists:

Such systematic information proves to be most useful in assessing structural - in this particular instance, technological - relationships between the input requirements, on the one hand, and the levels of output of various industries, on

²⁸ See on these points my more developed works (Archibugi, 1972, 1973a, 1973b, 1974, 1978).

the other. In the case of households, these relationships would be between total consumers' outlay and spending on each particular type of goods. Stocks of equipment, buildings and inventories, their accumulation, their maintenance, and their occasional reduction are described and analyzed in their mutual interdependence with the flows of all kinds of goods and services throughout the entire system.

Detailed, as contrasted with aggregative, description and analysis of economic structures and relationships can, indeed, provide a suitable *framework* for a concrete rather than purely symbolic description of alternative methods of production and the realistic delineation of alternative paths to technological change [*ibidem*, p. 152].²⁹

Thus, another important point on which should be characterized the general conception of a 'frame of reference', is that concerning the level of generality to which the expressions of collective preference are conformed, on the basis of the level of the aggregation of the frame.

Very aggregated models imply the fixing of very aggregated quantitative targets. And Frisch repeatedly dedicated his 'methodological' invitation to refuse the exaggerated fixing of starting targets in aggregate terms – without having carried out a detailed examination of all the possible frame of optimal combinations (scenarios). One can say - reading his last writings that were published posthumously - that this was the obsession of his final years.

The *ultimate* goal of the selection analysis is to arrive at a set of quantity targets for the development of the economy over the years to come. But before reaching this ultimate phase of the selection analysis there is a long way to go [...]. One example of this mistaken and naive approach is the one which - more for reasons of simplicity than for reasons of realism - is so popular in many Western countries..., namely the procedure of starting by estimating the *probable future growth rate* of the gross national product and subsequently from this estimate to deduce, by input-output analyses, national accounts etc., the consequences for different sectors of the economy and put these figures up as targets.

Much unclear thinking on planning methodology stems precisely from the crude target-setting way of thinking. In particular much unclear thinking about the usefulness or futility of a precise formulation of the overall national *preferences* stems from the target-setting way of thinking. Most of the arguments against the possibility of a precise preference formulation on the overall national level is based on the erroneous conception that such a formulation should pertain to a complex of *quantity targets*.

If it did pertain to quantity targets, the criticism would be well founded. But in

²⁹ Leontief widely developed the cognitive contents for the construction of such a *plan frame* in another paper during his participation to a consulting committee (promoted jointly by the US Congress and President) on the 'national growth policy process' in 1976 (Leontief, 1976b). They are very similar to that developed in 1972-1974 by the 'Frame Project' for the Italian Plan (see the works cited by Archibugi, 1972, 1973, 1974).

fact the situation is quite different.

In a rational planning system the precise formulation of a national preference does not pertain to a complex of given quantity targets but to something quite different [...]. In a rational planning system we have to start by ridding our minds completely of the target-setting approach and proceed through successive steps.³⁰

Here too Frisch's aversion is reiterated concerning the approach to set targets (targets which are in any case vague) on which to build aggregate models of little value and significance.³¹

Frisch's positions (1958) furthermore add a particular emphasis about questions of the *optimum*:

The method of target fixing has many defects. In the wide and complex system in which the economic life of a country is involved, the impacts are spread not only in one direction, but in all directions. *They form a network and not a chain.* From this it derives that planning cannot be adequately described as starting from certain elements – however important they might appear at first glance – or as obtaining the other elements by computation. All must be considered *simultaneously*.

Once one takes complete account of all this, it seems evident that, when a plan has been elaborated with the target fixing method (for instance a national annual budget or a long term plan) is not available for us any means or any instruments to verify if that is the *best alternative* that we can realize given the circumstances.³²

If one abandons the road of great aggregations, and takes that of the construction of greatly detailed alternative scenarios, it is evident that the amount of continually updated data and information, concerning the real state of the economy must be huge.

In fact Leontief notes:

The technical apparatus we would require in order to project such detailed realistic images is bound to be quite intricate and very costly, as is the inside of a television set. When it comes to preparation of a national economic plan, no effort should be spared in making use of the most dependable data-gathering and data-handling techniques and of the most advanced economic model-building and computational procedures. [...]

The selection of strategically commanding points in which to apply direct

³⁰Frisch dedicates sections 4.3 to 4.22 of the quoted work to the illustration of this passage (Frisch R., 1963, reprinted 1976).

³¹ It is impossible not to note here that until today the totality of the economic policy debates, either scientific and political, follow such an approach. The Frisch follower, or the programming approach follower, cannot be astonished in front of the current dominant trend, and even more when this trend is supported by academic debate.

³² R. Frisch, 'Generalities on Planning' in *L'Industria*, October-December, 1958.

influence or control as well as choice of the method or of a combination of methods to be applied *in each point* bring about compliance with the plan has to be based on *the concrete study of the specific configuration of economic flow* [italics mine, op. cit. pp. 154-156].³³

And, Frisch (1958) on the same theme wrote:

The research about which is really the best or optimal alternative requires a combinatory technique even more sophisticated than the best target fixing procedure....To advance concretely on these lines will require an effort of work and analysis greater than that necessary to act following the target fixing method, but I believe that the research for the optimal plan configuration will be the method of the future....

When the various projects are summarized and melded together in the table of the flows of actual activities, in such a way to form a program scheme integrated for the current operations, we dispose of an analytical instruments of great value. By means of the technical coefficient of such systems – determined for the most part by statistics and partly also by experts – the various dimensions of the activities for the current years will be connected by equations. This table will make us able what presumably can happen if are adopted some measures.

Beyond the program as such and the consequent equations for the current year's activities, the considered variables will be subject to certain conditions under the form of constraints derived by the technical capabilities, by mobility or immobility in the labor market, and so on, and also by the constraints expressed by certain political goals. All this material will be elaborated by the theme committed in the plan elaboration.

Anybody who has practice in these models will know how limited the possibilities are to find a truly good alternative, when one proceeds by trial and error, posing many times the interrogative: what will occur if this or that measure is adopted? It is just at this point that we need to make recourse to the numerically determined preference function.

On the basis of that function, and of the equations and constraints of the model, it would be possible to formulate and to solve the problem of researching the optimum, i.e. it would be possible to determine the configuration of the variables which will maximize the preference function, subject to the equation and the constraints relative to the current years.³⁴

³³ Further information in another essay by Leontief, 1976b, already cited.

³⁴ A trial to bring ahead the vision of Frisch and Leontief compacting a system of disaggregate programmatic economic accounts (in conventional sense, i.e. founded on input-output matrices, as on a central model and other fiscal and regional models, etc.) with a social goals system (articulated through a social indicator system), has been developed by the Planning Studies Centre in the '70s on the commitment of the Italian government (see the summary expressions of that trial in Archibugi, 1972, 1973a, 1973b, and 1974).

4. The Programming Approach and ‘Economic Policy’

We have said at the beginning that, facing – as we made – the requirements of a “true” programming (or planologic) approach, we can ask ourselves which kind of relationship have all this, i.e. the programming approach either on the theorems or on the current debate of economic policy. And furthermore, in which way does all this have a response within the scientific literature of economic policy that have had in the history of economic thinking a role so important and central. So central, however, to render poorly perceived the necessity to distinguish the contents developed under the term, ‘economic policy,’ and that under the term, ‘economic programming,’ or ‘planning’.

Any good textbook or treatment of economic policy in fact includes – dealing with the “theory” of economic policy – the aspects of a rational approach to the coordination of the different acts of economic policy, that is considered – implicitly or explicitly – the proper field of programming.

However, is not included with sufficient clarity, the substantial difference existing the possible theorems of a economic policy based on a programming approach (which I don’t see why should not be named, more directly and more simply, ‘economic programming’) and those of economic policies based on a non-programming approach. In this case have a role a customary interest, which should not deserve much attention if not had, on the contrary, a role to give credit to practicalness and a habit to the non-programming approach supported by the custom of the economists to develop also direct consulting roles to the policy maker in matters of economic decisions, and sometimes also direct roles of political management. Between economic policy in its traditional sense, and the programming approach, has been insinuated the “theory of economic policy” (of which the undiscussed promotor has been Tinbergen himself), and more precisely the ‘theory of *quantitative* economic policy’.³⁵

However even on this aspect, I prefer to refer to original texts as that of Tinbergen which follows:

We may summarize what we think are the essential differences between an

³⁵ All the well known initial works by Tinbergen constitute some pillars of the ‘theory of economic policy’ seen as a kind of procession: the first (1952) which outlined the method; the second (1954) which approached the centralization and decentralization aspects of the methods; the third (1956) dedicated to a refinement of the theory and to the design of many model casuistics, the most aggregate; then the last, which marked the passage from ‘theory of economic policy’ to a ‘theory of planning’ (1964). The last represents the turning point, but not as decisive as the work of Frisch’s last years, towards the programming approach. Halfway there is the work of Heal (1973), still strongly influenced by the macroeconomic approach, and therefore on the aggregate quantitative policies, to which both Frisch and Leontief began to express severe criticism. Even the quoted Johansen (1977-1978) grew in the mixed humour between Frisch and Tinbergen, in his most mature work was moving decisively toward a programming approach (in comparison to his first work, much more well known, on public economics, (1965) which is still within the orbit of Tinbergen.)

unplanned and a planned policy. The characteristics features of a planned policy are...:

1. Estimation of future developments as a basis for policy decisions instead of relying on the past evidence available at the moment of decision.
2. The explicit formulation of more general aims of policy, in the ideal case for the economy as a whole, instead of incidental action.
3. Coordinated action instead of random action by individual ministries or services.

The process from an unplanned to a planned policy in the sense just explained has been a very gradual one. Long ago, when the word planning had not yet been invented, the elements of planned policy just enumerated were not wholly absent. Thus, even if no formal forecast were made, policy makers had some ideas on what the future course of events might be. In many cases they may have used, consciously or unconsciously, what we now call one of the 'naive' methods of forecasting – for instance, by simple extrapolation of recent movements or by assuming no movement at all. As is well known, cyclical downturns were not foreseen, leading to overproduction or, once they had occurred, to overpessimistic views on future development.

The formulation of aims of policy became more necessary after the belief in laissez faire was given up. Before that time there was non need for planning, since it was believed that free economic forces would lead to the best development conceivable. When this belief died it became necessary to formulate norms for optimum development. One of the current difficulties is that among many politicians, probably as a consequence of our education system, a preference exists for thinking in qualitative terms only. But an economic policy must be based on quantitative as well as qualitative formulations.

Coordinated action finally is somewhat at variance with widespread acceptance, in Western countries at least, of the individual responsibility of ministers. Strictly speaking, each minister is free to determine his own policy. Cabinet policy, in the form of coordinated action, is not even a legal concept in many countries. In practice, most governments have a cabinet policy in dealing with larger issues and with emergency situations. The realization of its necessity developed in wartime and in the period of the Great Depression. For developing countries cabinet policy is more and more considered essential, as a consequence of the emergency of extreme poverty in which they find themselves.

The most important characteristic of coordinated action is the avoidance of inconsistencies. Inconsistencies may exist among the aims and they may exist between a set of aims and a set of instruments considered admissible. An elementary example of inconsistency in aims is one where a country would aim simultaneously at: 1) increased consumption, 2) increased investment, 3) decreased foreign assistance, and 4) decreased production, e.g. by a decrease in working hours. This set of aims violates one of the relationship of fundamental significance in economics, namely the overall balance equation saying that national product plus foreign assistance must equal consumption plus

investment.

More complicated possibilities of inconsistency may occur when the number of instruments a government is willing to apply is smaller than the number of targets it wants to attain. In a somewhat general way we may illustrate this situation by assuming that a government wants to attain balance of payments equilibrium and full employment but is prepared to apply only one instrument, namely government deficit or surpluses on current account. In most situations the level of government deficit necessary to attain full employment does not coincide with the level needed in order to equilibrate the balance of payments. The inconsistency does not now necessarily exist between the aims of the policy as such; if the government were willing to apply an additional instrument of policy, e.g. changes in the exchange rate or in the level of wages, the two targets might be attained simultaneously.

Inconsistencies in development policies will above all present themselves in the shape of neglect of the numerous complementarities which are characteristic of an efficient process of development. A well-known example is the neglect of an important quota for spare parts, which must complement imports of capital goods of all sort. Another typical example is the lack of repair facilities often leading to a large stock of relatively new capital goods remaining unused, for instance buses in local transportation. A third example is the lack of coordination between the process of building and the ordering of new capital goods, leading to the situation when for several months machines have to be stored without being used, or worse, remain in the open air exposed to weather influences. In one country where it was customary to build a hotel next to a new factory in a remote area, for possible visitors, a shortage of financial means prevented the factory from being built although the hotel was already completed. In another – otherwise extremely successful – country the road system is far behind the development of manufacturing industry. An important inconsistency in the execution of the plan of a big country resulted in a tremendous vicious circle bottleneck: a shortage in steel because of a shortage of coking coal, a shortage of the latter because of the shortage of freight cars, and a shortage of cars because of the shortage of steel. There are numerous other possibilities of inconsistencies in development policies, that is, any deviations from the relationship representing the most desirable development.

Inconsistencies can often be most easily discovered by the use of exact methods of analysis, i.e. by a mathematical approach. In practice this need not mean a very complicated approach, but it does imply an explicit rather than an intuitive treatment, and an expert treatment rather than a popular or 'practical' approach. Well-trained economists were pointing out possible inconsistencies long before planning was practiced, and economic analysis remains the main ingredient for coordinated action. Mathematical formulation will help a good deal, however, in arriving at a succinct statement of the essential questions involved. [Tinbergen, 1964, p.42-46].

5. Conclusion

It is thus to this set of components of a policy-oriented approach to the future, in the medium and long term, that it is advisable to strongly bind future studies on planning: much more so than in the past.

In fact, despite sage critical warnings given by the best qualified exponents of methodological reflection on planning (such that they may be correctly considered the "founding" fathers of planology, and the first formulators of the programming approach), in actual practices of planning, and even more so in actual urban, regional, social and economic planning practices this insistent, reiterated, passionate invitation for a correct formulation has been radically ignored.

This is so odd that it would alone deserve analysis. The weight of a traditional conception of economics and economic policy has impeded not only the acquisition, but also the awareness of the recommendations given above, not only on the part of those who have been fundamentally unfavorable to planning, but also by those who were favorable to planning and active and engaged protagonists of it.

This is why, when faced with the prospect of a relaunch of planning studies, it should be necessary that these studies start on the right tracks, with the constitution of a direct derivation from some basic concepts (in the field of modeling and procedures of approach) which have been already expressed by the authors cited and by some others, but with regard to which it is necessary to reconstitute a much more consolidated and not ephemeral methodology.

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