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NOTES ON THE TESTABILITY OF ECONOMIC THEORIES*

TWO THEORIES ABOUT ECONOMIC THEORY FORMATION

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Introduction

In the first part of this article we intend to indicate a traditional theory about the testability of economic theories. This theory is based on a rationality postulate: rationality is *presupposed*. The second part will deal with a second theory on economic theory formation, in which rationality occurs as a *result*.

We hope to make it clear that many economic scholars start from a testability of theories which is impossible. If these scholars, however, strive after such a testability from some notion of scholarship these strivings (whether consciously or not) must have reasons different from reaching this testability. In the second part of this article we shall – by means of a supposition as regards these different reasons – develop an alternative theory about theory-forming behaviour which does not only describe this behaviour but explains it as well. We state that theory-forming conduct is determined by a specific set of motives.

If economic theory cannot simply be tested and if in spite of this a model of theory formation must be developed we shall have to turn to aspects which cannot be reduced to the denominator of «pure science» or «pure scholarship». It is rather the «scientist» who plays an important part then. From this point of view a theory about theory formation can be described as a theory of behaviour. With respect to the *forum* of scientists we regard a theory of behaviour as the correct starting-point to develop an alternative theory of economic theory formation.

Like the way in which rationality forms the starting-point of traditional theories, so the *interest postulate* constitutes the premise of our second theory. This postulate indicates that observation is

mainly led by the interest of the individual and that, moreover, this interest leads to group formation. Individuals with common interests will unite into a group while the group may adjust individual interests. We shall try to make it clear that this group process results in rationality in the sense of the traditional theory.

1. Testability of Economic Models

1. In I it will be pointed out that falsifiability of economic theories is not trivial.⁽¹⁾ We shall base our case on the work by A.G. Papandreou [7] and F. Vandamme's notes on it [12] and we intend to give comment. Put in a wider framework section I will give an account of an investigation into the testability of economic theory in which we shall not pay attention to ethic-normative aspects of an economic theory. Our main scope is to give a logical treatment of the subject, which means that our only interest will be the logical form of economic theory. By the testability of a theory we shall mean its falsifiability. The criterion of falsification in this context is assumed (and not accounted for) in spite of our doubts about the correctness of this criterion with respect to economic theory formation.

The striving for falsification, as brought out by K.R. Popper [9], is central to our discussion and by falsifiability we shall mean the possibility of a theory to be rejected on account of perceived facts. The striving for falsification of a theory is regarded by K.R. Popper as one of the animating factors in the development of sciences. The Popperian development of sciences differs in this respect fundamentally from the process of development as formulated by for example T.S. Kuhn [6]. In choosing for the criterion of falsification we follow J.J. Klant [5] who sees the striving for falsification as central also for economic theories.

In general the falsification demand appears to be too severe.⁽²⁾ It also occurs that a theory is falsified whereas there are no good substitutes, at least not immediately. In this case falsification stimulates research.

At this stage we should relativize a little with reference to the criterion of falsification. Although by the acceptance of the demand of falsifiability historicity cannot sufficiently be framed in the theory

(K.R. Popper [8]), we do recognize the importance of historicism in the economic theory (formation). To us the falsification demand is not a criterion, but one of the possible starting-points. However relevant logic may be for ordering classes of observations and deducing predictions and although logic is of eminent importance to describe the structure of an economic theory, our analysis will be restricted to that brand of economics which can be made mathematically precise (A.G. Papandreou [7]): economics will be regarded as a descriptive discipline, by which we shall refrain from the problems of «welfare economics».

2. The logical form of economic theory is thought of as a deductive economic system. Such a system is primitively expressed by:

$$(1) T := \{f(x) = \gamma \mid x \in X, \gamma \in \mathbb{R}, f \in F\}$$

A theoretical term x ($x \in X$) is mapped into a real number by means of the specific function $f \in F$.

Thus f can be regarded as the function that orders the world of theoretical terms, that is to say the function that indicates a mutual connection of theoretical terms. The expression $f(x) = \gamma$ thus has the character of a statement. The set of statements forms the economic theory T . With F we may think of the set of economic regimes (on the theoretical level), for example perfect competition, oligopoly and monopoly.

In general a different vectorfunction f' implies a modified statement $f'(x) = \gamma'$, given the set of theoretical terms $\{x \mid x \in X\}$. This modified statement then is a necessary part of another theory T' which, as we know is formed by the set of statements.

We could imagine f as a utility function. Within the world of theoretical terms it orders sets of goods and the utility connected with these sets.⁽³⁾

When formulating a theory, however, we cannot start with ordering theoretical terms. We shall first have to take observations in the field of (economico-) social acting. Then we must «translate» these observations into the theoretical level. Apparently a necessary condition to achieve theory formation is the possibility that observations can be rendered into theoretical terms. We shall assume that such a rep-

resentation exists. The observations are regarded as connected with certain theoretical variables by means of the relation U .

$$(2) U := \{(x, a) \mid x \in X, a \in A, x U a\}$$

This expresses that there is a theoretical representation of the world of observations $\{a \mid a \in A\}$, in which A stands for the set of observations, in the world of theoretical terms $\{x \mid x \in X\}$.

By means of quantors the following statement can be given with the help of (2):

$$(3) \exists f \in F \forall a \in A \forall x \in X \exists \gamma \in R [x U a \rightarrow f(x) = \gamma]$$

in which « \exists » represents the existential and « \forall » the universal quantor. In (3) we see the relation U appear as necessary and sufficient condition for $f(x) = \gamma$. It is also formally described in (3) that for different γ and the same f another connection of theoretical terms is implied. Expression (3) gives different statements for different γ 's.

It could be asked now in how far observations are context-dependent and the observer «judges». If they are we must indicate a so-called «social space» (Papandreou [7]) in which the observations have been taken. The degree to which the observer can be determined in his observations by the world in which and from which he observes is illustrated by the following example. This example examines in how far the context of the observations is classified within or outside the theory (also see Vandamme [12]).

We oppose two possible worlds: monopoly and oligopoly. At first sight criterions to distinguish these two worlds seem to be obvious. Papandreou [7] states:

«Monopolistic behavior M is presumed to hold in situations in which a firm recognizes its power over price (that is to say over the buyer), but does not recognize its interdependence with other firms whereas oligopolistic behavior O is presumed to hold in situations in which some firms recognize their power over price, but at the same time recognize their interdependence.»

In this way monopolistic behaviour is defined as a behaviour that complies with certain laws. If these laws are not complied with there is no monopolistic behaviour, which means that a theory about

monopolistic behaviour on the basis of such a definition can always be kept from falsification by means of an appeal to conventional stratagems. If, namely, the laws are not confirmed by the observations we are not in the «social space» M. ⁽⁴⁾

We introduce a variable k which represents on the theoretical level the observations of properties that are included in the set of K of all possible worlds. Thus we get an expression adjusted to the circumstances

$$(4) \exists f \in F \forall k \in K \forall x \in X \forall a \in A \exists \gamma \in \mathbb{R} [(k \in K \wedge x U a) \rightarrow f_k(x) = \gamma]$$

The predicate of (4) now becomes – via arguments from proposition logic⁽⁵⁾ – :

$$(5) k \in K \rightarrow ((x U a) \rightarrow (f_k(x) = \gamma))$$

in which k determines the «social space» outside the theory. This statement is falsifiable, for if k is given the statement is false if the third term is false and at the same time the second term is true. Given the social space and given a correct rendering of contextbound observations into theoretical terms a false third term leads to falsification of the statement and so to a process of searching for the true third term. For that matter (5) can be kept from falsification by remarking that the representation of the world of observations in the world of theoretical terms is not correct. The fact that the second term may be untrue makes falsification of the statement as a whole impossible.⁽⁶⁾ The crucial question in indicating the social space is, whether we can identify the factual social space without having to use theoretical terms. If for example we didn't have to define monopolistic behaviour on the basis of the question whether it complies with well defined laws on a theoretical level (see the example of Papandreou) but if we could define this behaviour on the level of economico-social acting itself (or on a metatheoretical level) the circularity seen in the example would be broken.

Besides observations $\{a | a \in A\}$ which are contextbound via $\{k | k \in K\}$ it may be wondered in how far observations of contexts themselves are theory-dependent (also see Hendry [3]). The observation k is regarded as included neither in an economic nor in a non-economic theory. However, is such an observation conceivable? For every empiric science it is namely true that an observation only

gets sense for the formation of a theory in so far as this observation can be reduced to a theoretically founded quantity. So an observation on itself is not a datum for the process of economic theory formation. The observation only gets the character of an economic datum in so far as it is connected to some economic theory. For this we introduce the relation V so that:

$$(6) V := \{(k^t, k) \mid k^t \in K^t, k \in K, k^t \forall k\}$$

The relation V transfers the observed world k into a theoretically founded quantity k^t . The argumentation for introducing this representation V is analogous to the argumentation for U -relation: xUa . Here we are namely dealing with theories on economic reality and not with reality itself. One thing and another leads to a reformulation of (4):

$$(7) \exists f \in F \quad \forall k \in K \quad \forall k^t \in K^t \quad \forall x \in X \quad \forall a \in A \quad \exists \gamma \in \mathbb{R} \\ [(k^t \forall k) \wedge (xUa) \rightarrow f_{k^t}(x) = \gamma]$$

the predicate of (7) can be written as:

$$(8) (k^t \forall k) \rightarrow ((xUa) \rightarrow (f_{k^t}(x) = \gamma))$$

We shall also analyse (8) on the possibility of being falsified. ⁽⁶⁾ If it is true that observation only gets sense if it is theoretically founded, one does not only «hear» but also «understand», in other words if the impossibility of an exogenous determination of the social space can be demonstrated the first term of (8) is in fact indefinite: it may both be true and false. This means, however, that if the second term is true (which may be assumed) and the third term is true, (8) may simply be considered true. If the third term is untrue this does not mean that (8) is untrue. To put it more strongly: if the first term is untrue this implies that (8) as a whole is true. Thus the system is not falsifiable, and a solution to this problem will have to be sought for.

3. In what precedes it appeared that falsification of the theory as we have formulated it leads to a circularity problem. The indefiniteness of the term « $k^t \forall k$ » in

$$(8) (k^t \forall k) \rightarrow ((xUa) \rightarrow (f_{k^t}(x) = \gamma))$$

which is the main cause of this problem therefore needs further

investigation. The question is if we can reach a well defined delimitation of the social space, independent of the theory T which is to be falsified. We shall indicate two possibilities and give a brief comment on them.

A. A first possibility concerns an endogenous determination of the social space in such a way that the theory which takes care of this can be separated from the theory which is to be falsified. We call a theory T separable into T_1, T_2 if $T_1 \cap T_2 = \emptyset$ and $T = T_1 \cup T_2$; in this case there are no statements which appear in both theories. Suppose T_1 supplies the required criteria for the social space and T_2 forms the theory of control. Then the following question has to be answered: Is it possible to separate an economic theory T into disjunct parts T_1, T_2 ? This seems hard to imagine. For suppose that T_1 is the economic – theory that sets the framework for a capitalism-context, that means if it represents the criterion for a capitalist economy, the theory of control with respect to this economy T_2 will have to contain parts of T_1 in order that a significant identification criterion is possible as regards a theory of control T_2 (put in a context described by T_1 , e.g. «socialism»). If this is the case « $k^i V_k$ » in (8) remains undetermined.

As an example of the way in which the social space is characterized in the economic theory we can mention the form of the investment function.

As criterion for the type of economics we use the independent variable in the investment theory.

«socialism» : $I = \Phi(B)$ (accelerator theory)

«capitalism» : $I = \Phi'(W)$ (profit theory)

B represents the rate of utilization of capital and W is a profit variable. The form of Φ, Φ' is not fully specified ($\frac{d\Phi}{dB} > 0$ and $\frac{d\Phi'}{dW} > 0$).

It is clear that in this simple example $T_1 \subset T_2$ respectively $T_1' \subset T_2'$; as it were a part of the theory of control has been used to provide a context theory.⁽⁷⁾ A possible solution to the problem ($T_1 \cap T_2 \neq \emptyset$) is a different statute of T_1 , e.g. a sociological one.

In the example before us this implies a limitation of both regimes based on a socio-political organisation structure. For example:

«socialism» : the State has the ultimate competence to take decisions.

«capitalism» : possible influence of the State, but ultimately the individual has the competence to take decisions.

As it appears from the word «ultimately» identification provides problems here, too. We shall go further into this possibility which supplies a non-endogenous determination of the social space.

B. The next argument has been put forward by B.B. Seligman [11]. He emphasizes the distinction between the action and the values, norms and motives which have led to the action. For example the action of buying as a consumer's behaviour.

The possibility to test the drafted demand function can now be achieved by establishing the factors which have led to the decision. The set of «decision factors» offers a logically independent level with respect to the set of observations of actions. This level gives insight into the preference scheme of economic subjects outside economic activity or factual economic behaviour. The action of choosing shows the preference which is already included in values, norms and motives. Such an approach makes it possible to explain economic action from a «general rule of connectibility» between experience and behaviour. Values, norms and motives then constitute interpretation rules on a meta-economic level, which, moreover, can effectuate a systematically justified connection between context, economic data or observations and theory formation. In this way the problems are in fact shoved on to other sciences, which have to account for the context (e.g. sociology, psychology). We would like to call this a «seeming» solution to the problem of the exogenous determination of the social space.⁽⁸⁾

Finally we briefly point to two circumstances which lay extra stress on the complex character of expression (8). Theory determining observations exists particularly for a social science like economics (cfr. Hendry [3]). This implies that U and V are to be regarded as functions of the theory T (see (1)): fact and opinion (almost) match. This hinders falsification very much. A second circumstance concerns the time dependence of the logical specification of (1). For in the course of several periods of time a theory can adapt itself as a result of

changes in information, insights and prospects to achieve an unambiguous falsification in (8).

II. On Rationality

In the second part of our notes we would like to formulate an alternative statute for rationality. We shall also try to give a synthesis between the traditional theory, based on the falsification principle, and the alternative theory, which starts from the way in which an individual experiences his environment. We shall now first develop our alternative theory, which is focused on the way in which (economic) scientists achieve the interpretation of a social space with an exogenous statute.

Comparable to the way in which an observation is determined by the object the relation man-environment may be determined by interest. Acceptance of interest-bound observation beside theory-bound observation leads to two possible views of theory formation. At one side there is T (according to (1)) as a set of statements which puts the observations in a manageable order, at the other side the conception

$$(9) T_i := \{f_i(x) = \gamma_i \mid x \in X, \gamma_i \in \mathbb{R}, i \in I\}$$

For every individual i from class I of persons (e.g. the group of economic scientists) this records how he experiences his environment, or appears to experience it. Whether with this it is defined how the person experiences his environment or *says* to experience it, is not relevant to our formulation of the problem.

Next to each other there are now the theories T and T_i . Acceptance of T leads for example to the demand that the observation should be made mathematically precise or formalizable within a theory (A.G. Papandreou [7]).

Acceptance of T_i , this is a «personal» theory, confronts us very quickly with sociological factors, notably with powerfactors. On the formal level T_i represents our interest postulate. This postulate constitutes the starting-point from which we shall achieve an alternative statute of rationality.

Interest may lead to a need of interaction with like-minded people and this in its turn gives rise to group formation in function of equal interests. The various T_i 's, that means the views of persons $i \in I = \{1, \dots, n\}$ concerning theory, provide in a group process a result T^* , a «group» view of theory. So this symbol T^* represents the relation of a group to its environment as the result of a group activity. In this context T^* can be interpreted as the result of intersubjective consensus within the scientific forum as regards the context of starting-points of (economic) research (J. Habermas [2])(⁹): «mainstream theory».

The need for interaction implies the need for a communication basis. To guarantee meaningful communication, that is communication fulfilling the needs for interaction and at the same time contributing to theory formation, this basis will in our opinion converge to a rational basis. By this is meant the basis which only allows the set of behaviours, which have been experienced as meaningful, of persons within groups of scientists with relation to theory formation. For the individual i it is relevant in this view that his interest, prompted by his need for communication, makes his behaviour become predictable. For this enlarges the chance of successful communication and with this the chance for the individual to contribute to (economic) theory formation. Rationality expresses itself here in predictable behaviour. Then rationality is essentially no presupposition, but a relation between i and his environment, which follows as a result.

The relation as well as the issue of the group process can be described as:

$$(10) \quad T^* = T^*(T_1, \dots, T_n; p_1, \dots, p_n)$$

in which T_i represents the individual theory and p_i the degree to which the views are responded to in the group or are understandable.

We should, however, realize that (10) has an «ex post» character, for in advance we do not know the various weights p_i . After the «scientific forum» we know the theory T^* , which for the time being is regarded as current, and we know the various conceptions T_i . A systematic comparison of T^* with the «personal theory» T_i tells us how great the weights p_i must have been. Thus (10) involves the problem that the current theory (i.e. the theory resulting from the

scientific forum) is formulated on the basis of weights p_i which are not known beforehand.

A possible solution is found by not starting from the weights p_i but from the personal estimation of the private weight, $E(p_i)$, in the forum. Instead of starting from the degree to which a person has been able to make himself understood in the theory formulating group (10) we can start from the personal estimation of the individual weight, or from the degree to which an individual can make himself understood in the group. When these estimations are established they will, however, start functioning in the group process as real weights and not as subjectively estimated weights. For we have seen that the ambition of each individual member of the group to be understood (as much as possible) leads to predictable behaviour. The group, too, behaves predictable for that reason, so that $p_i = E(p_i)$ for all i .⁽¹⁰⁾ We have recognized (10) as an *ex post* relation, and the starting-point «ambition to be understood» enables us to formulate the *ex ante* relation, in which a conception of behaviour with respect to individual, group and group result is explicitly expressed.

$$(10)' \quad T^* = T^*(T_1, \dots, T_n; E(p_1), \dots, E(p_n))$$

In this way theory formation is a function of the individual conception T_i and also of the degree to which the individual thinks this personal view will find an appreciative hearing.

Thinking over the question, what the individual bases the estimation of his own weight on, we will very soon find out that the explaining factor is the quantity of information which is available to this individual. This information question is of fundamental importance in the subjective determination of the intelligibility factor. The more somebody knows about somebody else's points of view the better he can estimate his own contribution in the forum.⁽¹¹⁾

However, our formulation does not exclude that the personal view T_i is formulated in function of the realization of «weight» in the scientific forum. In this case T_i should be regarded as determined by the expectation of personal views of other participants in the discussion. Now information does not only determine the personal estimation $E(p_i)$ but also simultaneously the publicized personal view T_i and the weight which this view brings with it. When there is sufficient information the «strategic T_i », which maximizes the value of the

personal weight, can be formulated. In this way theory formation is solely a function of the expected weight in the scientific forum. Implications of this view for the functioning of the group process in service of scientific theory formation can be guessed.⁽¹²⁾

Via our convergence-thesis theory-formation leads to a distinctly evolutionary development in science. Developments by jumps, however, are possible as a result of the dynamic process with reference to T which we indicated in I.3, as a result of the changing views on this praxis. For with reference to interest we can speak of time-dependency. This is often prompted by a changing praxis. For example great unemployment leads to a concentration of investigation into unbalances on the labour-market. This may quickly bring existing theories up for discussion. Non-evolutionary developments in science can be accounted for by putting T_i as dependent on the period.

In our views time-dependency and convergence are no incompatible categories. Within one period, characterized by T^* (or in part I: T) there is convergence. For the rest results of convergence are incomparable when measured in various periods. This is connected with the historical determination T^* (respectively T) in a period.

It would be interesting to make an investigation into the relation between T and T^* , in other words into the manner in which and the degree to which an individual influences the views of a group or the scientific forum. Bibliometrical research might be a good starting-point here. As regards content we might think of studying reviews, polemics and publication policy (both of the magazine and the author). A «who-quotes-whom» investigation might be a starting-point.

Finally we shall try to give a summary of our argumentation and a synthesis with respect to the indicated traditional and non-traditional relations of the individual to the theory formation.

If we see T (according to expression (1)) as the result of a given process we can wonder which is the motive that will lead to precisely this result. We have pointed out how important sociological factors are, particularly group processes. This alternative theory of theory formation is based on an interest-postulate⁽¹³⁾ and consequently

offers the possibility to formulate a certain type of theory of behaviour for scientists who are together in forum.

Our interest-postulate motivates the ambition for «intelligibility». An individual's reason to champion a certain theory implies that as a scientist he will try to make himself understood in the group of scientists. He will render his theories into generally accessible phenomena, that is on the basis of personal motives he will try to find supports for his theories which are understandable for others.⁽¹⁴⁾

Our train of thought and our proposal for a synthesis can be schematized as follows:

$$\begin{array}{c} (T_1, \dots, T_i, \dots, T_n) \xrightarrow[\text{«weights» } (p_1, \dots, p_n)]{\text{group process}} T^* \\ T \end{array} \left. \vphantom{\begin{array}{c} (T_1, \dots, T_i, \dots, T_n) \xrightarrow[\text{«weights» } (p_1, \dots, p_n)]{\text{group process}} T^*} \right\} T^* \Rightarrow T$$

the upper line of the diagram gives the alternative theory (part II) the lower line represents the traditional theory (part I).

In T_i we find embodied: man and intuition as the most important thinking power. Communication and power factors are found back in the relation between T_i , ($i = 1, \dots, n$) and T^* , in which the latter represents the contribution to economic theory formation. The symbol T^* stands for rationality as a phenomenon, resulting from the scientist's ambition to make himself understood, enabling him thus to contribute to the theory formation as a result of (partial) acceptance of his view by the forum.

$T^* \rightarrow T$ expresses that the group process as a time process shows a tendency towards reaching T , which has been described in I. This means that not only in the group the members try to reach a maximum intelligibility, but also that the group as a whole tries to reach a maximum intelligibility in its environment. But in this case we can connect rationality as phenomenon, as result (T^*) and as motive for the activity of the scientist (T , see part I): $T^* \rightarrow T$. This constitutes our synthesis of alternative and traditional theory with respect to theory formation.⁽¹⁵⁾

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NOTES

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(¹) Strictly speaking falsifiability of no theory and consequently of no economic theory is trivial. This must be ascribed to the circumstance that falsification of any theory T is logically equivalent to the verification of the negation of T.

(²) If we regard natural sciences as «highly developed» and if we realize that in these sciences the falsification possibility is not without problems, this will certainly be the case for theories in the domain of social sciences.

(³) The utility function (which has as its domain the commodity space $X \subset \mathbb{R}^n$ mapped into $Y \subset \mathbb{R}^1$) exists and is continuous if the preference-relation to the commodity space X, which is at the basis of this utility function, complies with the axioms of «completeness», «continuity» and «transitivity» (H.S. Houthakker [4]). These requirements may, if necessary, be mitigated a little.

(⁴) The argument used by H. Albert can in proposition logic be rendered by the following truth table:

$p \rightarrow q$		
1	1	1
0	1	0

In other words: A theory can always be prevented from falsification by appealing to the fact that the presuppositions on which a theory is valid are not complied with. H. Albert mentions the fact that economists often use the ceteris paribus clause as alibi clause. (Albert [1]).

EXAMPLE

Suppose M is the world of *monopoly* situations; assume that producers (c.q. firms) recognize their power over price, but do not recognize their interdependence with other producers. We describe a certain firm's behaviour in M by maximizing its profit $P(x)$, defined by

$$P(x) = x \cdot p(x) - C(x), \text{ where}$$

x is the output of the firm,
 $p(x)$ the price of output, and
 $C(x)$ is a cost function (differentiable)

The firm's behaviour is expressed by

$$(*) \quad \frac{dP}{dx} = 0 \rightarrow p(x) \left(1 + \frac{1}{\eta}\right) = \frac{dC}{dx},$$

where η is the price elasticity of good x .

The expression at the right hand side of the implication (*) is the rule 'f_M' identifying monopolistic behaviour. If it is not satisfied, there will be no monopolistic behaviour in that case. In this way, a theory about behaviour in M can always be protected from falsification.

Analogously, in the world O of *oligopoly* situations (where firms simultaneously recognize their power over price and their interdependence) profit P₁ of firm 1 may be formulated by: (suppose we have firms 1 and 2)

$$P_1(x_1, x_2) = x_1 \cdot p(x_1, x_2) - C_1(x_1),$$

where x_1 is the output of firm 1

x_2 is the output of firm 2

C_1 is the cost function of firm 1

Though somewhat more complicated, profit maximization will also yield some rule 'f₀', enjoying the same properties with regard to falsification that we pointed out in the M-world of monopoly situations

Of course, the world of competitive economics can be viewed upon analogously.

$$(*) ((p \wedge q) \rightarrow r) \Leftrightarrow (p \rightarrow (q \rightarrow r))$$

1	1	1	1	1	1	1	1	1	1
1	1	1	0	0	1	1	0	1	0
1	0	0	1	1	1	1	1	0	1
1	0	0	1	0	1	1	1	0	1
0	0	1	1	1	1	0	1	1	1
0	0	1	1	0	1	0	1	1	0
0	0	0	1	1	1	0	1	0	1
0	0	0	1	0	1	0	1	0	1

(*) Because of the impossibility to falsify the *predicate* of the expressions (4) and (7) (see the expressions (5) and (8)) it can be concluded that the *whole* expressions are not falsifiable.

(7) As regards its content we can further explain that $T_1 \cap T_2 \neq \emptyset$ with the aid of the two given investment functions which are considered typical of a social environment. With reference to a parameter ε , $\varepsilon = 0$ or $\varepsilon = 1$ these two functions can be written as

$$I = \varepsilon \Phi(B) + (1 - \varepsilon) \Phi'(W)$$

In general we can write the investment function as

$$I = \delta \Phi(B) + \eta \Phi'(W), \delta > 0, \eta > 0.$$

The value of δ, η determines both the social space expressed in T_1 and the theory of control T_2 within the social space! In this case the current social regime cannot be characterized on a theoretical level outside T_2 , the theory of control. Moreover, for what values of δ, η do we regard capitalism or socialism as current? T_1 is not only defined by elements belonging to T_2 , but in addition the ultimate characterization of T_1 forms a moment which is arbitrary on an economico-theoretical level.

From this we can explain the search for a non-economic statute of T_1 .

(8) By exogenous theoretical foundation we here mean a foundation outside the economic theory, in this context a meta-theoretical foundation. For example via sociology and psychology one can reach k' with the help of the relation V on the basis of

observation k . This must be done without the support of economic theories. If the latter is impossible there will be circularity. If that possibility does exist one should reckon with circularity on the level of non-economic theory. A characterization of the social space with the help of non-economic theories excludes circularity on the level of economic theory but elsewhere the problem may return. For that matter sociologizing the starting points of economic theory formation does not guarantee that this theory can systematically be justified from the field of (economic) acting itself. For the starting-points can be based on a sociological theory which in itself has been set up absolutely arbitrarily, according to a free design (see H. Albert [1]).

⁽⁹⁾ Cf. the relation between correspondence theories and consensus theories, with regard to the truth conception. Also compare the notion «plausible» which is used by J. Klant as a norm for accepting or rejecting starting-points of economic theory (J. Klant [5]).

⁽¹⁰⁾ $P_i = E(P_i)$, for all i should thus be interpreted as an ascertainment by hindsight. For the rest such a specification does not exclude the appearance of «snow-ball»-effects in which one individual theory conception quickly gains in acceptance and therefore becomes «weightier».

⁽¹¹⁾ A general formulation, taking into account the information problem, is given by $T^* = T^*(T_1, \dots, T_n; E_1(\hat{T}, q_1), \dots, E_n(\hat{T}, q_n))$ in which $\hat{T} = (T_1, \dots, T_n)$.

The variable q_i stands for the quantity of relevant information which is available to the individual i . For the rest the problematic nature of the realization of T^* has a clearly game-theoretical background.

⁽¹²⁾ This conception can be rendered by the expressions:

$$T_i = T_i(E_i(\hat{T}, q_i)); i = 1, \dots, n; \hat{T} = (T_1, \dots, T_n)$$

$$T^* = T^*(T_1, \dots, T_n; E_1(\hat{T}, q_1), \dots, E_n(\hat{T}, q_n))$$

the personal conception T_i formulated in function of the maximum weight in the forum.

⁽¹³⁾ It could be wondered if the interest-postulate is perhaps also an expression of a certain process. One might for example think of the interest which is guided by talent or ambition.

⁽¹⁴⁾ Further foundation is not necessary where motive and phenomenon appear in one figure: the transcendental moment.

⁽¹⁵⁾ E.g. Joseph SCHUMPETER was in his 1948 address to the American Economic Association optimistic that the collective intercourse of scientists gradually cumulates the durable truths distilled from successive waves of ideologically contaminated inquiries. So in our terms he concludes that there exist prescientific cognitive acts which are the source of the personal views T_i which give rise to the formation of T . (J. Schumpeter [10])

REFERENCES

- [1] ALBERT, H., «Modell-Platonismus», from Karrenberg, Friedrich and H. Albert. «Sozial Wissenschaft und Gesellschaftsgestaltung», Berlin, 1963.
- [2] HABERMAS, J., «Zur Logik der Sozialwissenschaften», Frankfurt, 1970.

- [3] HENDRY, D.F., «Econometrics – Alchemy or Science?», *«Economica»*, 1980, pp. 387-406.
- [4] HOUTHAKKER, H.S., «The Logic of Preference and Choice», from *«Contributions to Logic and Methodology»*, Amsterdam, North Holland, 1965.
- [5] KLANT, J.J., *«Spelregels voor Economen»*, Leyden, 1979.
- [6] KUHN, T.S., *«The Structure of Scientific Revolutions»*, Chicago, 1962.
- [7] PAPANDREOU, A.G., *«Economics as a Science»*, Chicago, 1958.
- [8] POPPER, K.R., *«The Poverty of Historicism»*, London, 1961.
- [9] POPPER, K.R., *«Conjectures and Refutations»*, New York, 1968.
- [10] SCHUMPETER, J., «Science and Ideology», *«American Economic Review»*, March 1949, pp. 345-59.
- [11] SELIGMAN, B.B., «On the Question of Operationalism», a review article, *«American Economic Review»*, March 1967, pp. 146-61.
- [12] VANDAMME, F., *«Economie en Wetenschapsfilosofie»*, Kapellen (De Sikkel) 1975.

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