

ON EXTENDING THE INSTITUTIONALIST PARADIGM: THE APPROPRIATE PLACE FOR SYSTEM DYNAMICS WITHIN THE ECONOMICS PROFESSION

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Abstract. After enduring years of criticism from prominent economists, many members of the system dynamics community have concluded that economists do not like system dynamics. This article argues that this conclusion is not entirely correct. The economics profession can be divided into two methodologically different camps: the mainstream or neoclassical economists and the institutional economists. Although neoclassical economists do not see system dynamics models as being scientific because they do not adhere to the tenets of logical empiricism, institutional economists construct models in a manner that is strikingly similar to the system dynamics method. Indeed, it is shown that system dynamics can be used to strengthen and extend the institutionalist paradigm in economics and thus has the potential to find a permanent home within the profession.

The computer people took seriously the evidence that people are not maximizing-rational and decided to find out by empirical study how decisions are actually made. Thus they became, in a way, heirs of the institutionalist program

Philosopher of Science Paul Diesing

INTRODUCTION

Some of the harshest criticism of the system dynamics method has come from the economics profession. One author for example, in a section entitled "Some Outrages in the Name of Modeling," categorizes system dynamics as a "toy" and as "an illustration of the type of senile maundering and immature egocentricity found in certain types of social system modeling" (Casti 1981, 418-419). Another observes that prominent economists think of system dynamicists as nothing more than "boy economists" (Greenberger, et al. 1976, 142). After having been exposed to numerous critiques of this nature over the years, many members of the system dynamics community have concluded that economists do not like system dynamics, and that economists do not feel the system dynamics method is appropriate for economic science (e.g., Meadows 1980).

One purpose of this article is to show, in terms of economic methodology and philosophy of science issues, that this conclusion is not entirely correct and that system dynamics has the potential to find a permanent home within the

economics profession. Although the majority of economists would indeed dismiss system dynamics models as being unscientific, there does exist a significant group of economists, broadly classified as institutional economists, who construct models in a manner that is strikingly similar to the system dynamics method. Thus, it will be argued that system dynamics can be used to strengthen and extend the institutionalist paradigm in economics. Conversely, a second purpose of this article is to show, in terms of economic methodology and philosophy of science issues, why the majority of economists do not embrace the system dynamics method.

CLASSIFYING ECONOMISTS

The task of dividing all economists into two methodological groups, each with an attached list of characteristics, is not unlike trying to classify all voters as either Republican or Democrat based on, say, each party's platform. Someone is always going to protest that neither classification completely describes his views. Nevertheless, it is common within the economics profession to divide economists into the neoclassicals and the institutionalists (Dugger 1979).¹ The distinction is made by examining an economist's views on the issue of what makes a model or theory generating an explanation of reality valid.²

The neoclassical or mainstream economists share both a common body of theory within their own discipline and a common method of explanation with other disciplines. The latter commonality, originally referred to as the "unity of science thesis" by Otto Neurath (Caldwell 1982, 16), is based upon a logical empiricist view of what constitutes a valid model or explanation. This view was first developed to codify the nature of explanation in the physical sciences and is characterized by the use of formal (mathematical) models and deductive logic. Logical empiricism was first united with economics by T. W. Hutchison (1938) in his book The Significance and Basic Postulates of Economic Theory (Caldwell 1980).

By contrast, institutional economists neither share a common body of theory nor embrace a unity of science thesis. This latter view stems from their belief that differences in scientific discipline require differences in scientific method. What does unite the institutionalists, however, is their common position on what constitutes a valid model or explanation in economics. Underlying this position is the belief that formal (mathematical) models cannot adequately capture the subtleties and important qualitative themes that exist in economic reality. As a result, the institutionalists construct descriptive "pattern models" of explanation. Institutional economics is thought to have been founded between 1880 and 1920 with the writings of John R. Commons (1961),³ Thorsten Veblen (1967), and Wesley Clair Mitchell (1950).

THE NEOCLASSICALS AND THEIR LOGICAL EMPIRICIST
PHILOSOPHY OF SCIENCE⁴

Logical empiricism can best be viewed as a type of synthesis between two competing lines of thought: rationalism and empiricism. Following the tradition of Rene Descartes, rationalists see the world as logical and orderly and believe that man can come to know it through reason alone. Consequently, any model or theory generating an explanation is considered to be valid only if it is logically correct.⁵ Empiricist thinkers on the other hand, in the tradition of John Locke, see the world as composed of a collection of discrete experiences. As a result, an explanation is considered valid only if it is based on observations.

Both of these views on the nature of explanation suffer from weaknesses. The rationalists' refusal to rely on empirical verification prevents them from being able to distinguish between numerous logically correct theories. The empiricists face Hume's problem of induction or the impossibility of certainty in generalization: Just because something is observed in the first n instances does not guarantee that it will be observed in the $n + 1$ instance. Logical empiricism is an attempt to combine the strengths of both lines of thought while avoiding these weaknesses.

The Deductive Covering Law Model

As numerous authors have pointed out (Cyert and Grunberg 1963; Wilber and Wisman 1975; Wilber and Harrison 1978, 1979), the essence of the logical empiricist method of explanation is embodied in Hempel and Oppenheim's (1948) deductive covering law model. Hempel and Oppenheim argue that their model is adequate to describe the nature of explanation as it occurs in science--be it natural science or social science. They maintain that "scientific" or "valid" explanations (models) adhere to the logical structure of the deductive covering law model and thus are distinguishable from ad hoc or unscientific explanations (models).

As shown in Figure 1, the structure of the deductive covering law model consists of two parts: an explanans and an explanandum (Kim 1967, 159; Cohen and Cyert 1975, 24; Mackenzie and House 1978, 8). The explanans is the explanation for a given phenomenon and is composed of at least one non-time-varying general law of nature (Ls) and antecedent conditions (Cs), which are facts about the world that pertain to the explanation in question. Both of these parts are required to be true or thought to be true and contain empirical content. The explanandum (E) or phenomenon to be explained takes the form of an empirically testable hypothesis that has been logically deduced (using mathematics or rules of logic) from the explanans.⁶

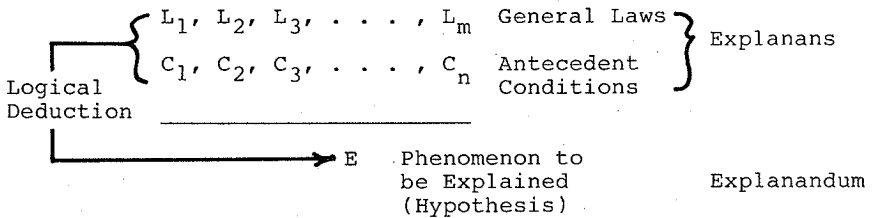


Figure 1: The Deductive Covering Law Model

Specifically, in neoclassical economics, the non-time-varying general laws of nature are interpreted to be the neoclassical's logically correct shared body of theory while the antecedent conditions are interpreted to be the assumptions and initial conditions under which the shared body of theory will hold true. The explanandum is mathematically deduced from the theory and tested using various statistical (econometric) techniques. Numerical data is chosen so as to correspond as closely as possible to the concepts embodied in the explanandum. The testing itself involves the estimation of the explanandum's parameters and the determination of their "statistical significance." The parameters are interpreted to be things such as marginal productivities and price elasticities. If an explanandum "passes" its statistical tests it is considered to be "confirmed." Neoclassical economic science thus proceeds forward as numerous logically correct theories and their confirmed hypotheses are accumulated.

Kim (1967, 159) has provided an example from the physical sciences of an explanation which adheres to the structure of the deductive covering law model and Cohen and Cyert (1975, 23) have provided an example from neoclassical economics:

Why did the walls of a room painted in white blacken? A possible explanation of this phenomenon is that (C₁) the paint contained lead carbonate, (C₂) sulfur was contained in the gas used for lighting the room, and (L) lead carbonate combines with sulfur to form lead sulfide, which is black.

In the immediate period following World War II after automobile production resumed in the United States, recently manufactured automobiles which were sold as "used" cars had higher prices than similar automobiles which were sold as "new" cars The explanandum, therefore, is a used 1946 car selling for a higher price than a new 1946 car of similar make and model. The explanans consists of the following:

C₁ Manufacturers set prices on new automobiles but not on used automobiles.

- C₂ Evidence indicated that at the prices set on new automobiles, the quantity demanded was greater than the quantity supplied.
- C₃ Dealers were able to transform new cars into used cars by having them driven a short distance.
- C₄ New car dealers also have used car lots.
- L₁ Firms (dealers) exploit known opportunities for increasing their profits.
- L₂ The Law of Demand indicates that at any particular price there are some consumers willing to pay a higher price if necessary to obtain the product.

The Symmetry of Prediction and Explanation

One additional assertion made by Hempel and Oppenheim regarding their deductive covering law model is that, within its framework, explanation and prediction must necessarily be symmetric. That is, the only difference between an explanation and a prediction is temporal. If the explanandum is deduced and tested against reality after events have occurred, the model yields an explanation. On the other hand, if the explanandum is deduced before events have occurred (or are discovered to have occurred), the model yields a prediction.

Hence explanation and prediction share the same logical structure and are differentiated only by the timing of events and the generation of the explanandum. In short, to predict is to explain. In Cohen and Cyert's example above, had used 1946 cars not yet sold for more than new 1946 cars (or been discovered to have sold for more than new 1946 cars) and if the explanans was known, deducing the explanandum would have been equivalent to predicting that used 1946 cars would sell for more than new 1946 cars.

Friedman's Twist on the Deductive Covering Law Model

Although it has been argued that the deductive covering law model provides the philosophical basis for explanation in neoclassical economics, it must be noted that a significant number of neoclassical economists adhere to a methodological position that is slightly different. Long championed by Milton Friedman and based on his 1953 Essays in Positive Economics (one of the most widely read statements on economic methodology ever written), this methodological position can best be described as the deductive covering law model with an added twist. Friedman's original purpose in writing the essay was to defend the neoclassical theory of the firm and its assumption of producer rationality, against behavioral theories of the firm which are based on empirical evidence showing that producers operate under

conditions of bounded rationality (March, Simon and Guetzkow 1958; Simon 1959; Baumol 1959).⁸

Friedman's basic position is that the assumptions under which a theory (Ls) can be expected to hold true, that is the antecedent conditions (Cs) in the deductive covering law model, need not be descriptively accurate for the theory to be considered valid. Instead, he argues that the validity of a theory should be judged by its ability to predict events that have not yet happened or that have not yet been discovered to have happened. Indeed, he goes even further by arguing that:

- 1) if, in the process of making the assumptions of theory more unrealistic the theory is made more general, it has been improved, provided it still predicts well; and
- 2) The choice between two theories that predict equally well should be made via the maximum use of Occam's razor: The simpler of the two should be chosen.

In the essay, Friedman supports these arguments by citing cases from physics, biology, and billiards. He notes for example that, although the law of falling bodies (i.e., that any falling body accelerates at 32 feet per second on the earth) is valid only in a vacuum, it can be used to make generally good predictions about the acceleration of bodies falling on the earth. That is:

in a wide range of circumstances; bodies that fall in the actual atmosphere behave as if they were falling in a vacuum. In the language so common in economics this would be rapidly translated into: the formula assumes a vacuum (Friedman, 1953, 18).

Hence, Friedman's conclusion is that neoclassical theory should be retained because it yields empirically correct deductive predictions about the behavior of firms and markets through the use of the assumption that producers and consumers act as if they are rational. In Paul Diesing's (1971, 30) words:

Friedman's defense consists[s] simply in shifting the locus of rationality from the individual to society, arguing that rationality is really a selective social mechanism that rewards those businessmen who for whatever reasons act 'as if' they were rational and punishes the rest. In other words, he suggest[s] a new empirical interpretation of the old formal models. He [does] not argue substantively that the models [have] been conclusively verified, but he [does] argue methodologically that evidence from consumer behavior [does] not count as disconfirmation.

An interesting side issue involves a debate on which methodological category encompasses Friedman's viewpoint. The

debate has arisen because his position on assumptions (Cs) violates a requirement of the deductive covering law model and thus makes it conceptually possible for a theory to predict without being able to explain. Wilber and Harrison (1978) insist that Friedman is still a logical positivist (empiricist) while Wong (1973), Boland (1979), and Caldwell (1982) feel he is an instrumentalist, or one who believes that theories are neither true or false but merely instruments that are adequate for the problem at hand. Gordon (1984, 373-374), however, notes that philosopher Karl Popper "equates instrumentalism with logical positivism and denounces them both." Also Blaug, a falsificationist and disciple of Popper writes that, "Friedman is not guilty of instrumentalism" (1978, 703), and refers to his essay as "Popper-with-a-twist applied to economics" (1975, 399).

For the purposes at hand, the way to view this side issue is to recognize that it is merely a side issue --one of fine-tuning. Regardless of whether Friedman's position on the descriptive reality of assumptions makes him a logical positivist (empiricist), an instrumentalist, or a falsificationist, the bottom line is that neoclassical economists share a common body of theory from which they mathematically deduce econometrically testable hypotheses (predictions). To them, any model or explanation that does not follow this format is unscientific.

Neoclassical Theory and Its Insulation

What is the body of theory that the neoclassical economists share? Eichner (1983, 510) has outlined four elements or theoretical constructs which he feels form the core of neoclassical microeconomic theory:

- 1) A set of indifference curves for each and every individual that when aggregated for all house holds represent the relative preferences for any two or more goods by the society as a whole;
- 2) a set of continuous, or smooth, isoquants for each and every good produced that when taken together represent all the combinations of labor and other inputs that can be used to produce those goods;
- 3) a set of positively sloped supply curves for all the different firms and industries comprising the enterprise sector; and
- 4) a set of marginal physical product curves for all of the inputs used in the production process, not just the labor inputs but . . . even more critically the "capital" inputs.

He notes that "one or more of these four elements is usually the basis for any microeconomic argument made by economists, and any argument that relies on at least one of these four theoretical constructs can be regarded as 'neoclassical.'"

Moreover he notes that neoclassical macro "theory is predicated on two additional theoretical constructs; . . . the Hicks-Hansen LM-IS framework and the Phillips Curve" (510-512).

In addition, the aforementioned assumptions of consumer and producer rationality and the mathematical result of equilibrium that necessarily stems from the process of maximization lie beneath this core of theory. As Samuelson (1983, 21) points out:

It so happens that in a wide number of economic problems it is admissible and even mandatory to regard our equilibrium equations as maximizing (minimizing) conditions.

According to the neoclassical's own argument, these theoretical constructs are retained because they yield logically deduced predictions that continue to be confirmed empirically. In reality, however, this body of theory has been retained even when some of its logically deduced predictions have failed empirical tests of confirmation. Documented evidence of the poor predictive record of neoclassical theory is presented by Schoeffler (1955), Von Mises (1962), Chalk (1970), Hutchison (1977), Grunberg (1978), and Jewkes (1978).

Neoclassicals defend their retaining of the theories by arguing that their predictions have not been conclusively disconfirmed empirically because of extenuating circumstances. For example, they point out that they, unlike physicists, cannot control all the variables that can affect the outcome of their "experiments" (things such as the overthrow of a foreign government, the weather, consumer fads, etc.). Hence, they are forced to make their predictions ceteris paribus or under the assumption that everything else will remain constant. A poor prediction then is often blamed on a loosening somewhere of the ceteris paribus assumption.

In addition, neoclassical economists note that the statistically constructed numerical data that they are forced to work with often does not conform exactly to the concepts embodied in the explanandum they are trying to test and they are thus forced to use proxy variables in their econometric models. A poor prediction then often is attributed to model specification errors caused by data limitations (see: Wilber and Wisman 1975, 670-672; Wilber and Harrison 1978, 66-69). Douglas North, however, may have revealed the fundamental reason that the neoclassicals passionately cling to their body of theory when he wrote: "to abandon neoclassical theory is to abandon economics as a science" (Boland 1982, 115).

So neoclassical theory continues to survive. Wilber and Harrison (1978, 68-70) argue that neoclassical economics has become completely insulated from disconfirmation. This is because the theory cannot be rejected for the lack of descriptive realism in its assumptions nor for its poor empirical predictions. They conclude that neoclassical

economics has really evolved away from logical empiricism and into a form of rationalism a la Descartes. In other words, if the theory is retained even when both its fundamental assumptions and deduced predictions diverge from reality, assent must be derived solely from an examination of its internal logic.

INSTITUTIONAL ECONOMICS

What is institutional economics and what are its methodological and philosophical foundations? In 1957 Kenneth Boulding described institutional economics as a movement of dissent from mainstream, orthodox economics that was initiated at the turn of the century by the "big three" of John R. Commons, Thorsten Veblen, and Wesley Clair Mitchell.¹⁰ Twenty-eight years later Bronfenbrenner (1985) has reached essentially the same conclusion.¹¹ To what then do Commons, Veblen, Mitchell, and their many lineal descendants object?¹²

Objections

The objections to neoclassical economics that are made by the institutionalists can be separated into three categories:

- 1) doubts as to whether a deductive covering law explanation is valid at all;
- 2) doubts as to whether a deductive covering law explanation is valid in economics even if it is valid in other disciplines; and
- 3) specific disagreements as to what should and should not be included in a "proper" economic analysis.

Each of these will be discussed in turn.

Rejection of the Deductive Covering Law Model

Institutional economists note that philosophers of science have long attacked the deductive covering law model as it applies to explanation in any scientific discipline. Bromberger (1970, 71), for example, claims that many "explanations" that fit the covering law structure are not true explanations and therefore, the nature of explanation cannot be characterized by the deduction of an explanandum from an explanans. To support this claim he offers the following thought experiment:

There is a point on Fifth Avenue, M feet away from the base of the Empire State Building, at which a ray of light coming from the tip of the building makes an angle of σ degrees with a line to the base of the building. From the laws of geometric optics, together with the "antecedent" conditions that the distance is M feet, the angle σ degrees, it is possible to deduce that the Empire State Building has a height of H feet. Any high school student

could set up the deduction given actual numerical values. By doing so, he would not however, have explained why the Empire State Building has a height of H feet.

Scriven (1963) on the other hand has attacked the alleged symmetry of prediction and explanation in the covering law model. He cites the case of individual suicides, which can be explained under a covering law structure, but certainly not predicted.

But, putting aside these criticisms for the moment, the question might be asked: What if it were generally agreed that the deductive covering law model can indeed describe the nature of explanation in many scientific disciplines (e.g., the natural sciences)? The institutionalists argue that it still cannot provide an adequate description of the nature of explanation in economics, and cite two reasons.

The first is that, unlike the physical sciences, no "universal laws" (Ls) exist in economics. Hutchison (1977, 19-20) for example, believes that neoclassical economists confuse "trends, tendencies, and patterns" that can change over time with universal laws (e.g., the law of gravity) that don't.

The second reason is that the inherent instability of economic data prevents generalizations about it from yielding successful predictions. In other words, the prediction of economic phenomenon is impossible in principle. Heilbroner (1970, 37), for example, argues that even though behavioral data are fairly stable in the long-run due to "the influence of habits, customs, traditions, and usages of societies," they are unpredictable in the short-run. Conversely he argues that production possibilities are stable and predictable in the short-run but unpredictable in the long-run, due to the influence of technological change. What this of course means is that the institutionalists also object to the neoclassical's unity of science thesis.

"Proper" Economic Analysis

The specific disagreements between the two groups of economists as to what should and should not be included in a "proper" economic analysis are numerous, and many of them will be treated implicitly ahead when the institutionalist's methodology is reviewed. Nevertheless, Boulding (1976, 397-401) has compiled a list of the major components of neoclassical economic analysis that the institutionalists feel are improper. It includes the observation that neoclassical economics:

- 1) lacks an empirical base for its theory;
- 2) lacks dynamics and is obsessed with the concept of equilibrium--a "figment of the human imagination;"
- 3) places too heavy a reliance on "atomistic individualistic psychology with no place left for human learning and

socialization" (i.e., individual preferences are simply given--not formed through learning);

- 4) does "not give adequate recognition to the role of social organizations and institutions in the formation of, not only human behavior, but of the whole economic activity in production, consumption, and exchange of commodities;"
- 5) does not pay attention "to the existence of community as a network of relationships and identities which profoundly modifies the mere atomistic interaction of individuals in exchange;"
- 6) carves out a piece of "the total social system and studies it without sufficient relationship to the other parts."

The institutionalist paradigm is essentially a response to these objections.

A Body of Knowledge

In addition to their dissension from neoclassical economics, institutional economists share a common view of the world. Warren Samuels (1969, 67), a former editor of the Journal of Economic Issues, the top institutionalist journal, observes that although "the historic meaning of institutional economics resides in . . . protest or reform . . . it is . . . also a body of knowledge." This body of knowledge stems from "a holistic and evolutionary view of the structure--behavior--performance of the economy . . . in a system of general interdependence or cumulative causation" (Samuels 1974, 41; Wilber and Harrison 1978, 73).

Similarly, Wilber and Harrison (1978, 71) note that:

at the most general level, institutional economics can be characterized as holistic, systemic, and evolutionary. Social reality is seen as more than a specified set of relations; it is the process of change inherent in a set of social institutions which we call an economic system. The process of social change is not purely mechanical; it is the product of human action, but action which is definitely shaped and limited by the society in which it has its roots. Thus institutionalism is holistic because it focuses on the pattern of relations among parts and the whole. It is systemic because it believes that those parts make up a coherent whole and can be understood only in terms of the whole. It is evolutionary because changes in the pattern of relations are seen as the very essence of social reality.

Thus, the institutionalists share a belief that the economy is an evolving,¹³ goal-directed, socio-cultural-economic system that moves towards the wants and desires of those individuals and groups that possess power (Gruchy 1969, 1975, 1977). As a

consequence, their analyses focus on the evolution of power, the formation of goals or values (both individual and collective), and the conflicts that arise among the various goals of the powerful (see: Schweitzer 1969). They also believe that technological change is the fundamental driving force behind the entire evolutionary process because of its ability to alter the distribution of power, and view markets (the foundation of neoclassical economics) as mere subsystems whose behavior cannot be understood in isolation from the larger socio-cultural system of which they are a part.

Within this overall scheme then, the institutionalists see the socio-economic system as being composed of three interacting sectors: the public or governmental sector, the monopoly capital/military industrial complex, and the laissez faire or competitive sector (composed of unorganized workers, small firms, and consumers). The monopoly capital sector is characterized by large corporations enjoying huge infusions of technology, concerted economic behavior, administered prices, limits on production, large surplus profits, and high wages. The competitive sector, on the other hand, is not "favored" by technology, and is characterized by fierce competition among its firms, low profits and wages, and fluctuating prices and output. The monopoly capital sector is thus thought to possess the majority of the power and is seen to routinely use it to: 1) exploit the competitive sector by making it bear the brunt of price, employment, and output adjustments while receiving the majority of surplus profits; 2) extract favors from the governmental sector; and 3) force the nation's goals and values to match its own (Gruchy 1977, 15).

As a result of this vision and given that they perceive the socioeconomic system to be evolving toward a structure which consists of more and more power groups that possess conflicting goals, the institutionalists believe that an expanded form of social management or social control is required. This management would take the form of national planning (in excess of the present monetary and fiscal policies) aimed at the establishment of policies that enable the system to respond to the "will of the people" and mitigate the exploitation and power struggles that are the inevitable result of the evolutionary process. As in some of the Scandinavian countries, these management responsibilities would be delegated to a national planning board which would use the political process to ascertain the nation's values or goals and then implement policies (the national plan) which would foster a feeling of fairness and cooperation between the various power groups and move the system toward these goals. Such a task is thought to be beyond the abilities of an unaided private market system.¹⁴

Feedback

The primary methodological tool that institutional economists utilize to produce their holistic and systemic analyses is Gunnar Myrdal's (1944, 1948, 1977, 1978) concept of circular and cumulative causation. As K. William Kapp (1976, 220) writes:

it is justified to regard the principle of interlocking circular interdependencies within a process of cumulative causation as the disciplinary matrix which provides institutional economists with a new tool for the identification and ordering of the relevant elements in the study of socioeconomic processes in their immensely diversified and changing complexity. More than this, the principle enables institutionalists (and other social scientists) to transform problematical situations and unsolved open problems . . . into 'puzzles' which can be solved even when a complete theory and the precise knowledge as to the 'coefficients of interaction' are not [yet] available.

In a similar way Gruchy (1977, 14) notes that:

The institutionalists are very interested in the evolutionary course along which the industrial economies are moving. The process of industrialization, in their opinion, has an inherent logic that imposes a common pattern or shape on the maturing industrial economies. This inherent logic is a reflection of the dynamic process of circular and cumulative causation in which there is an interdependence among a number of factors, prominent among which is technological change.

Historically, the feedback concept is evident throughout the writings of the prominent institutional economists. John R. Commons (1961, 1968), for example, implicitly spoke of positive and negative feedback loops when he continually referred to "limiting versus complementary factors" and "evolving, self-correcting capitalism." James O'Connor (1973) argues that the fiscal crisis of the state has occurred because it must spend to create an environment for easy, monopolistic capital accumulation so that it can siphon off surplus value. The accumulation must be made to appear "legitimate" to the people however, and this requires the expansion of social spending which feeds back to exacerbate the need to siphon off surplus value. Kapp (1976, 218) notes that

Veblen developed and used the principle of circular interdependencies of a number of factors within a process of cumulative causation in connection with his analysis of the function of the leisure class, the role of technology and credit particularly in connection with his explanation of the business cycle, and the inflation of all monetary values.

Finally, a feedback, general systems approach is at the core of virtually all of the economic analysis done by Kenneth Boulding (1956; 1964; 1968; 1972; 1973a; 1973b), whose collected papers alone span six volumes. Two ideas that have appeared quite frequently in his work are that: 1) society influences knowledge and learning and in turn, knowledge and learning feed back to influence society; and 2) a correct

theory of the firm should be one that includes the "homeostasis of the balance sheet:" the idea that all producers have a desired state of their firm's balance sheet and behave so as to keep the actual balance sheet at this state.

A Common Methodology

An integral part of the institutionalist's body of knowledge is their program for conducting economic analysis. Dugger (1979) has directly compared this methodology to the one adhered to by neoclassical economists. He cites the writings of both Abraham Kaplan (1964) and Paul Diesing (1971) when he argues that "institutionalists seek to construct pattern models (theories) of explanation while neoclassicals seek to construct predictive models (theories) of explanation" (p. 900). The hallmark of a pattern model is understanding which is facilitated by the detailed, descriptive realism of its structure or pattern. The hallmark of a predictive model is predictive realism which is obtained from a highly simplified (vis-a-vis reality) structure. To the neoclassicals then, to predict is to explain,¹⁵ whereas to the institutionalists, to understand is to explain.

The unit of analysis or "root of human action" used by the institutionalists to construct their pattern models is, not surprisingly, the institution. Firms, unions, schools, churches, clubs, and other actual entities with a defined culture, set of goals, rules, customs, etc. are institutions. Following a behaviorist psychological perspective, the institutionalists believe that a man's preferences are shaped (learned) over time by the environment in which he lives, works and plays. Hence, they bring no predetermined assumptions about individual behavior into an analysis.

Alternatively, the unit of analysis or root of human action that is utilized by neoclassical economists in constructing their predictive models is the theoretical maximizing consumer or producer. Following a subjectivist psychological perspective,¹⁶ the neoclassicals argue that a man's preferences are determined by his individual utility function which is based upon predetermined assumptions about rational behavior.

Participant Observers, Themes, and Pattern Models

The pattern modeling approach of the institutionalists has its foundations in the traditional case study method that is used in such fields as business administration and cultural anthropology (see: Vayda 1967). Diesing (1971, 141) argues that the participant-observer technique is the most appropriate one to use when constructing a pattern model from a case study because:

the only instrument that is good enough for studying human beings is man himself. Only the human observer is perceptive enough to recognize and appreciate the full range of human action; only the

human thinker is able to draw the proper implications from the complex data coming from human systems.

The participant-observer is very much like a detective piecing together an explanation of a crime or a physician piecing together a diagnosis of a patient's ailment.

In order to utilize the participant-observer technique most effectively, the institutionalist must first become "socialized" within the economic system so as to be fully exposed to its structure.¹⁷ From this vantage point the institutionalist is able to become aware of recurring "themes" that illuminate the wholeness or unity of the system. Rewards, sanctions, power relations, conflicts, and institutional norms of behavior are examples of themes. The institutionalist is not seeking universal laws, but information that is pertinent and unique to the system he is studying. Emphasis is placed on locating the causal relationships of the system (see: Garb 1964, McClelland 1975). Because none of the traditional economic boundaries bind the institutionalist's search, most pattern models end up taking on a very cross-discipline, social science flavor.

The institutionalists's interpretations of the themes he locates become hypotheses that must be carefully cross-checked and confirmed so as to neutralize any biases he may possess. Tools such as historical studies, questionnaires, statistics, personal interviews, and other case studies can be used by the institutionalist to facilitate this process. Confidence in a theme is usually gained when several types of information from different sources, converge. Themes which cannot be confirmed, i.e., those that, after further study, are deemed not truly part of the system's structure, are discarded and new ones sought. Thus the process, by its very nature, is iterative.

Once the institutional economist is convinced that he has identified the valid recurring themes or "parts" of the system's structure, the next step is to link them together into a descriptive network, or pattern model of explanation. As with the assemblage of a jig-saw puzzle the emphasis shifts to the identification of the links between the various parts of the system that define its wholeness or pattern. By doing this the institutionalist is attempting "to capture the interactive relationship between part and whole" (Wilber and Harrison 1978, 76).

From this notion then, one is able to appreciate Kaplan's (1964) distinction between the type of model or theory that would be used by a neoclassical economist: hierarchical, and the type of model or theory that would be used by an institutional economist: concatenated. In a hierarchical model lower level, specific instances of general laws (explanandums or predictions) are deduced from the higher level, non-time varying general laws (explanans), and then empirically tested. In a concatenated model on the other hand, the explanandum and explanans can be thought of as being

linked together and then empirically tested at the same level of generality. It is the concatenated model as a whole, and not one part in isolation, that is relevant. Consequently:

one cannot deduce specific predictions of future behavior in novel circumstances from a pattern explanation; the symmetry of prediction and explanation that occurs in a deductive model is not present. In a deductive explanation one can with equal facility explain the past and predict the future, but in a pattern explanation one can only explain. To be sure, if there is no novelty one can predict that the pattern will continue unchanged, but one does not need science to make that sort of prediction. In novel circumstances one may be able to say that a certain range of behavior is likely and another range of behavior unlikely, but not that any specific thing must occur (Diesing 1971, 164).

Thus, a pattern model or concatenated theory is confirmed empirically, not by econometrically testing deduced predictions, but by determining if it is "descriptively accurate" or able to fit "well" the set of relationships it is trying to explain. One way that the institutionalists make this determination is by seeing whether newly arriving information is consistent with the pattern or story that they're trying to tell. However, this is made extra difficult as, unlike the non-time-varying general laws used in predictive models, the structure of the real-life economic system being described is constantly evolving. Consequently, the structure of the pattern model must be continuously updated and revised. A particular pattern model remains confirmed until a new pattern model that is able to account for a greater variety of data, displaces it.

Typologies

Extension of the institutionalist approach past the pattern modeling stage involves the assemblage of a typology. Kapp (1961) argues that there are two kinds of typologies: real types and ideal types. Institutional economists assemble real types by gathering together similar case studies or pattern models and identifying the commonalities. According to Diesing (1971, 198), "a real type groups a number of cases together because they have many important characteristics in common. It is more like a mode than a formal construct." The real type is then used to guide research and direct inquiry into the next case. Some examples of institutionalist real types are Veblen's stage theory of capitalism, Common's concept of "reasonable capitalism," and Galbraith's planning system (see: Wilber and Harrison 1978, 78).¹⁸

By contrast, neoclassical economists can be said to construct ideal types. These are "abstract system[s] or process[es] based on a few postulates. [They are] idealizations in the sense that one does not expect to find any pure empirical examples of [them]" (Diesing 1971, 198). They are formed by starting, from the very beginning, with a logical structure

that can yield different deductive situations when its postulates are systematically varied. An example of a neoclassical ideal type is the model of pure monopoly as "one can vary its postulates and move on to monopsony, duopoly, obgopoly, oligopsony, cartels, etc." (Diesing 1971, 199).

General Characteristics of Human Systems

The final step in the institutionalists' methodology, at least on paper, is to compare and contrast many different real types and glean from them general characteristics of human systems. In contrast to neoclassical economics which begins with atomistic theories, Diesing (1971) argues that this last step is where holistic theories are formed. According to Wilber and Harrison (1978, 78-79):

Comparison of widely varying types enables one to identify still more general characteristics of many types of human systems--universal or nearly universal values, institutions, system problems, mechanisms, and the like General theorizing of this kind attempts to transcend the relativity inherent in the pattern model approach by seeking general characteristics of human systems.

Of interest, however, is that the institutionalists believe there is only one instance of an institutional economist working past the pattern model and typological steps to this stage: Gunnar Myrdal and his theory of circular causation!

Table I provides a summary of the differences between neoclassical methodology and institutionalist methodology as has been outlined in this article.

A Lack of Rigor

It has been demonstrated that institutional economists have developed a legitimate model of explanation in response to their objections to neoclassical economics. As Caldwell (1982, 203) writes:

Few could fail to be impressed by the institutionalist methodological research agenda It is a grand and ambitious vision. Indeed, by comparison standard economic analysis seems terribly restrictive, static, narrow, even pedestrian. Institutional analysis, if successful, is social science in the fullest sense of the word.

The institutionalist approach, however, is not immune from criticism. Its most frequently cited weakness is a lack of precision and rigor. According to Wilber and Harrison (1978, 84), the task for future institutionalists is to determine a way of adding rigor so as to retain and enhance, rather than destroy, the creativity and insightfulness of a participant-observer-constructed pattern model, for:

Table I

A Comparison of Neoclassical and
Institutionalist Methodologies

<u>Neoclassical</u>	<u>Institutionalist</u>
1. A common, objective model of explanation unites all science in all disciplines.	1. A common model of explanation unites all institutionalists, but not necessarily with other scientific disciplines.
2. Seek to construct predictive (hierarchical) models or theories.	2. Seek to construct pattern (concatenated, Gestalt) models or theories.
3. Hallmark of model or theory is predictive realism obtained from a highly simplified structure.	3. Hallmark of model or theory is understanding which is facilitated by descriptive realism in its structure or pattern.
4. Basis of predictive model is laws (theory).	4. Basis of pattern model is facts.
5. Prediction = explanation.	5. Understanding = explanation
6. Individual maximizing consumer or firm (theoretical) is unit of analysis.	6. Institution (actual) is unit of analysis.
7. Psychological perspective is subjectivism.	7. Psychological perspective is behavioralism.
8. Individual preferences are determined by a man's personal utility function, i.e., they are given.	8. Individual preferences are molded by the institutions in which a man lives, works, and plays, i.e., they are learned.
9. Individual behavior is predicted, i.e., explained when it is deduced from basic postulates and initial conditions. There are thus preconceived assumptions about behavior.	9. Individual behavior is understood, i.e., explained, when it is documented and shown to fit into an institutional structure of behavioral norms. There are thus no preconceived assumptions about behavior.

10. Predictive model is tested empirically by comparing deductions (quantitative predictions) with observations. Emphasis is on statistical correlation.
 11. View is atomistic and static with analyses based on timeless universal laws.
 12. Emphasis is market economics.
 13. Ideal typologies are formed from logical structures that yield different deductive situations when their postulates are systematically varied.
 14. The construction of a predictive model begins with general theoretical laws of human behavior.
 10. Pattern model is tested empirically by comparing hypothesized institutional structures (qualitative patterns) with observations. Emphasis is on causation.
 11. View is holistic, systemic, and evolutionary.
 12. Emphasis is system economics. Market is subsystem of the larger socioeconomic system.
 13. Generalities from different pattern models are assembled into a real typology.
 14. Holistic theories employing general characteristics of human economic systems are the end result of the institutionalist method. Myrdal's theory of circular and cumulative causation is the only existing example however.
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a central problem of any methodology is how to strike a balance between precision and rigor on the one hand, and vagueness and suggestiveness on the other, and how to relate to the two so that they synergize rather than cancel each other.

In a more general sense, Caldwell (1982) sees the present level of development of the institutionalist method as representing merely the skeleton of the approach or the foundation for its future. He suggests that the institutionalists explicitly highlight the pattern modeling approach in their research so as to attract followers that will both use and extend it.

SOME HELP FROM COMPUTER MODELING?

Given its lack of rigor and need for extension, a legitimate question to ask is whether any potential assistance exists for the institutionalist program. Numerous researchers have noted that some types of computer modeling can be thought of as extensions of the case study approach (e.g., Simon 1979, 508; Cyert, Feigenbaum and March 1959; Dutton and Starbuck 1971; and Forrester 1980a, 1980b). In fact, Diesing (1971, 166) has specifically observed that "some case-descriptive computer models may also be interpreted as pattern explanations." The main problem, however, is that institutionalists dislike formal models. This dislike stems from their perception that a formal (mathematical) model is incapable of capturing the subtleties and important qualitative themes of a particular case:

[The] characteristics of institutionalism--holistic, systemic, evolutionary--combined with an appreciation for the centrality of power and conflict and the recognition of the importance of nonrational human behavior, differentiate institutionalism from standard economics. Formal models simply cannot handle the range of variables, the specificity of institutions, and the nongenerality of behavior (Wilber and Harrison 1978, 72).

Although the skepticism of the institutionalists toward formal models may be valid when applied to the area of computer modeling in its most general and loosely defined form, it is not universally valid. Indeed, what the institutionalists have not yet been alerted to is the existence of the system dynamics method, which is strikingly similar to their pattern modeling approach and capable of handling "the range of variables, specificity of institutions, and nongenerality of behavior" that is characteristic of the structure of their explanations. In fact, as will be shown below, in a number of areas the system dynamics method is even more advanced than the institutionalist method and can be used to shore-up its weaknesses. To date, the only economist that has even hinted

at the potential usefulness of system dynamics modeling in institutional economics is Bruno Frey (1974, 46-47).

INSTITUTIONAL DYNAMICS: AN EXTENSION OF THE INSTITUTIONALIST PARADIGM

The marriage of institutional economics and system dynamics into what might be called "institutional dynamics" seems entirely logical if one compares them side by side. Both system dynamicists and institutional economists share a holistic, systemic, and evolutionary view of the world and hence a similar view of what constitutes "proper" economic analysis.

As Richmond (1985) has noted, all systems that are composed of living things and exist in a changing environment exhibit goal-seeking behavior--and goal-seeking behavior requires the existence of feedback structure. Hence, the most fundamental of system dynamics principles is that the dynamic behavior of any system is generated by rates of flow that are integrated or accumulated into stocks which are part of its feedback network or structure. This of course is precisely the concept behind Myrdal's theory of circular and cumulative causation and entirely consistent with the behaviorist view of the institutionalists.²⁰ In addition, system dynamicists regard equilibrium in economic systems (or in models of economic systems) the same way that institutional economists do: as a useful concept for the purpose of reference, but not at all a description of the actual state of any system. This is because equilibrium requires that all of the stocks in a system simultaneously equal the goals they are seeking--an enormously unrealistic situation.

Case Studies, Themes and Feedback Loops

The foundation for both the institutionalist method and the system dynamics method is the case study. The strength of the case study approach vis-a-vis other research methods is its ability to incorporate descriptive (mental or perceived) information, as well as numerical information, into an analysis.

The formal steps taken to build a system dynamics model from the information contained in a case study parallels closely the steps taken to build an institutionalist pattern model from the information contained in a case study. Just as the institutional economist, acting as a participant-observer, searches a system for themes that illuminate its oneness or wholeness, the system dynamicist searches a system for feedback loops that comprise the system's causal structure. The institutional economist joins together cross-checked and confirmed themes into a descriptive pattern model of explanation, while the system dynamicist joins together the feedback loops that he perceives as important into a system dynamics computer model.

Although this step is conceptually the same in both approaches, the use of system dynamics by the institutionalists could introduce needed rigor into their pattern models. This is because the translation of the concepts embodied in a theme (especially important metaphysical concepts) into source code requires the precise description of what is meant by the concepts. Further, institutional economists become convinced that a theme has been confirmed when information about it from different sources converges. System dynamicists utilize this same criteria to select feedback loops, but regard it as insufficient. This is because system dynamics models are bound by the rule that requires their structure to consist solely of those feedback loops that contribute to its ability to endogenously reproduce the behavior of the actual system. This additional requirement arises because a system dynamics model can be simulated, a characteristic not shared by pattern models. Simulation adds rigor and clarity to the descriptive richness of a case study because it reveals the dynamic behavior inherent in the system structure that is thought to be important. Thus, system dynamics can offer institutional economists both a rigorous means of clarifying and confirming their themes and a medium for better understanding the evolutionary behavior of the pattern models they build.

Confirming Pattern Models and Building Confidence in System Dynamics Models

Institutional economists believe that the confirmation of a pattern model occurs when it is judged to be descriptively "accurate" and when newly arriving data is seen to fit the pattern "well." Unfortunately, they have no agreed-upon standards that define what "accurate" and "well" mean. Also, they note that the task of confirming a pattern model is especially difficult because economic systems are constantly evolving and the structure of the pattern model must evolve with them. Finally, they lament the overall subjectivity and lack of rigor in their confirmation process and concede that it will never be as neat and clean as the econometric tests of the neoclassicals.

System dynamicists are, of course, well acquainted with these issues regarding the confirmation or "validation" of a model and have developed a line of thought on the subject that can be of enormous aid to the institutionalists. Their basic argument is that all model validation procedures (even econometric) are subjective, and they even dismiss the notion of a model being "valid," substituting instead the concept of building confidence in a model along several dimensions. Forester (1973), Forester and Senge (1980), Richardson and Pugh (1981), and Sterman (1985a) all have listed up to 17 questions that they feel should be asked of a model. Among the 17 are rigorous questions involving such things as statistical measures of how "well" the model's synthetic data fits historical numeric data (Sterman 1985a), as well as many that are qualitatively oriented.²¹ A policymaker's confidence in a model is supposed to increase each time he is able to give a satisfactory answer to one of the questions.

Of more importance to system dynamicists than building confidence in any particular model, however, is their belief that insights and understanding about economic systems are derived from the modeling process itself and not the model. As Forrester (1985b, 133) notes:

models are always in a continuous state of evolution. Each question, each reaction, each new input of information, and each difficulty in explaining the model leads to modification, clarification, and extension.

Such a perspective complements well the institutionalists' requirement that pattern models evolve with the changing economic system and can provide them with a new outlook on the entire issue of confirming a pattern model.

A Focus on Policy, Not Prediction

Institutional economists and system dynamicists also share identical views on the issue of prediction in socioeconomic systems. Both groups believe that the prediction of socioeconomic phenomenon is impossible in principle, except in the very short run, due to the inherent instability of the subject matter. Forrester (1961) for example, has elegantly demonstrated this on behalf of the system dynamicists in Appendix K of Industrial Dynamics.

Instead of prediction then, the institutionalists and system dynamicists focus on the formation of values and the determination of policies that will move the socioeconomic system towards its goals. An "institutional dynamics" approach could provide the institutionalists with a laboratory for developing and presenting for debate, national plans (policy scenerios) aimed at improved system behavior and the resolution of the conflicts that exist between the goals of competing power groups. An explicit computer representation of an institutionalist pattern model, along with a diagnosis of behavior and a comprehensive set of policy tests, could go a long way towards facilitating an improved understanding of socioeconomic problems and in forging a national concensus on the composition of a national plan.

Typologies and Generic Structures

Perhaps one of the most interesting areas of similarity between system dynamicists and institutional economists is in their treatment of the methodological steps past the pattern model/computer model stage. Institutional economists admit that although a pattern model is very specific representation of a particular system, similarities often can be observed between completely different cases. They gather these similarities together and assemble them into a real typology. These "real types" are then used to direct inquiry into future cases.

In precisely the same way, system dynamicists argue that although a particular system dynamics model is a formal and rigorous representation of a specific system, all system dynamics models are composed of the same fundamental building blocks: positive and negative feedback loops. This had led them to the discovery of different systems (cases) whose behavior can be reproduced by models composed of the same basic combinations of feedback loops. These "generic structures" are equivalent to an institutional economist's real types. The system dynamics approach, however, ensures that cases are members of the same typology through the rigor of simulation. Some examples of generic structures would be Forrester's Urban Dynamics model, which he claims should be able to reproduce the behavior of any city, provided the proper parameters are used (Forrester 1973, 45), or, even more generally, a negative loop with delayed corrective action--the fundamental structure of any system that oscillates.

Paich (1985) has recently written about the potential of generic system dynamics structures. He sees them as playing primarily an educational role, i.e., strengthening the mental models of policy makers. As an illustration of this, Forrester (1985a, 3-4) envisions that some day a catalog of generic structures will be stored in a personal computer on the desktop of virtually every corporate manager because:

twenty or thirty [generic] models would cover 80% to 90% of the situations that managers encounter . . .
 . [These] models [would] represent the transferable generalizations from special managerial cases, and carry with them the indicators for determining whether or not a particular generic model fit a specific management situation.

In a similar way one can envision the discovery and assemblage of a catalog of generic institutional dynamics structures (real typologies) that would be available to aid economic policy makers. For example, Ward (1977) has written in great detail about the many similarities that exist between the case studies of John Kenneth Galbraith (1971) and James O'Connor (1973). Research aimed at the possible extraction of a generic feedback structure from these writings is presently underway at the University of Notre Dame. Paich (1985) on the other hand argues that researchers at the Massachusetts Institute of Technology have already discovered a generic macroeconomic structure (see: Sterman 1985b).

General Characteristics of Human Systems

As previously noted, the final step in the institutionalists' methodology is the gleaning of similarities from different real types and their assemblage into "general characteristics of human systems." Also, as far as the institutionalists can tell, Gunnar Myrdal's theory of circular and cumulative causation is the only existing example of an institutional economist working through the pattern model and real type stages to this level. Here once again is a place where the

system dynamics method not only parallels the institutionalist approach, but can also extend it.

Myrdal's theory of circular and cumulative causation posits, as its name implies, that the structure of any economic system consists of feedback loops. System dynamicists, of course, have long known this to be a general characteristic of human systems. Indeed, system dynamicists such as Richardson (1983; 1984), Meadows (1980), and Saeed (1980), have previously cited Myrdal in their work.

An institutional dynamics approach can be viewed as an extension of the institutionalists' methodology at this stage because research by system dynamicists has already produced a formal list of general characteristics of human systems. Forrester (1969) cites some of these in Chapter 6 of Urban Dynamics as does Meadows (1982). Aside from the agreed-upon fact that human systems are complex feedback systems, they observe that they:

- 1) are of a high order (i.e., contain many accumulations or integrations);
- 2) are highly nonlinear;
- 3) are multi-loop and the dominant loops shift over time;
- 4) are counterintuitive: the causes of system problems and the symptoms of system problems are not closely related in time and space; hence the leverage points or places where a policy change can alter the system's behavior are located in counterintuitive places, and the direction that the effort from a policy change must be applied in order to correct problematic behavior is often counterintuitive;
- 5) are insensitive to most changes in their parameter values and to many changes in portions of their structure resulting from policy interventions;
- 6) can drift to low performance;
- 7) often will shift the burden of a problem to a policy intervenor;
- 8) can become addicted to a policy or action that produces a short-term appearance of desired change but actually causes a continued deterioration of the system.

A New Unity of Science Thesis

One final observation regarding the notion of general characteristics of human systems is that such a classification may not be broad enough. A fundamental premise of this article is that neoclassical economists adhere to a logical empiricist unity of science thesis. It has been further argued that although institutional economists dissent from this cross-discipline unity of science thesis, they feel that

institutional economic analysis itself should be conducted in a unified manner.

Of interest then is the work of Ludwig von Bertalanffy, one of the founders of general systems theory. For the purposes here, his ideas can best be summed up by citing the title of his seminal 1951 article published in Human Biology: "General Systems Theory: A New Approach to the Unity of Science" (von Bertalanffy 1951; see also the responses to von Bertalanffy's thesis made by Hempel 1951, Bass 1951, and Jonas 1951 and see Boulding 1956).²² In other words one might argue that perhaps institutional economists should not dissent from all unity of science theses, but only from a logical empiricist unity of science thesis. As Forrester (1969, 107) has written: "the processes of man and nature, of psychology and physics, of medicine and engineering, all fall within a [feedback] structure."

Table II provides a summary of the similarities between the institutionalist approach and system dynamics approach as has been outlined in this article.

Summary and Conclusions

In this article it has been argued that repeated criticism of system dynamics by prominent economists has caused many members of the system dynamics community to conclude that economists do not like system dynamics. It has been shown that this conclusion is not universally correct. Economists can be divided into two methodological camps: the mainstream or neoclassical economists and the institutional economists. The neoclassicals believe in a logical empiricist unity of science thesis which states that a model or explanation in any discipline must be constructed in a manner that is consistent with the structure of Hempel and Oppenheim's deductive covering law model. Because neither the pattern models of the institutionalists nor the computer models of the system dynamicists meet this requirement, they are seen by the neoclassicals as unscientific.

Institutional economists on the other hand, dissent from the notion that the logical empiricist model of explanation is the only type that is legitimate. As was shown, the institutionalists employ a pattern model of explanation that is very different from the one used by the neoclassicals. What is most striking about their approach however, is its close similarity to the system dynamics method. A number of places were identified where the system dynamics method can strengthen and extend the institutionalists' methodology: in adding rigor and discipline to the selection and confirmation of themes, to the process of building confidence in a pattern model, to the process of formulating a national plan, to the process of extracting real typologies from assorted pattern models, and to the process of deriving general characteristics of human systems from real typologies.

Thus, judging from the striking similarities in method, and the stated weaknesses and appeals for future research that

Table II

Similarities Between the Institutional
and System Dynamics Approach

<u>Institutionalist</u>	<u>System Dynamics</u>
1. Approach is in response to objections regarding mainstream, neoclassical economics: e.g., deductive covering law structure of explanation, theories based on producer/consumer rationality and concept of equilibrium, statistical (correlational) testing.	1. Approach is attempt to model reality. Overcomes objections made by system dynamicists regarding mainstream neoclassical economics: e.g., deductive covering law structure of explanation, theories based on producer/consumer rationality and concept of equilibrium, statistical (correlational) testing.
2. View is holistic, systemic, evolutionary, and behavioralist.	2. View is holistic, systemic, evolutionary, and behavioralist.
3. Foundation of approach is the case study.	3. Foundation of approach is the case study.
4. Perceptions of participant-observer are translated into pattern model.	4. Mental model of system dynamicist is translated into computer model.
5. Participant-observer searches for themes that illuminate the oneness or wholeness of the system.	5. System dynamicist searches for those feedback loops that are able to endogenously reproduce the behavior of the system.
6. Participant-observer uses available information from any source to confirm a theme.	6. System dynamicist uses mental, written (descriptive), and numerical data bases to identify important feedback loops.
7. Themes are joined together into a descriptive pattern model of explanation and understanding.	7. Feedback loops are joined together into a computer model of explanation and understanding.
8. Pattern model is confirmed if it is descriptively accurate and if new data is seen to fit the pattern well.	8. Confidence in the computer model is built along several dimensions via at least 17 questions that can be asked of the model.

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|--|--|
| 9. Real typologies are formed by gleaning similarities from pattern models of different cases. | 9. Generic structures are identified by observing computer models of different cases that are composed of the same basic feedback loops. |
| 10. Holistic theories and general characteristics of socioeconomic systems are formed/identified by gleaning similarities from different real types. Myrdal's theory of circular and cumulative causation is the only example that has been identified thus far. | 10. Holistic theories and general characteristics of socioeconomic systems are formed/identified by gleaning similarities from different generic structures. A significant list has already been assembled. Entire method is based on theory of circular and cumulative causation. |
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emanate from the institutionalist community, system dynamics has the potential to play a prominent role within institutional economics. In fact, an "institutional dynamics" approach may one day propel the institutionalists past the neoclassicals to the forefront of the economics profession.

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ENDNOTES

- 1) Some economists might consider this classification to be too broad. An alternative scheme might divide economists into those from the Chicago school, the Austrians, the neoclassicals, the institutionalists, the Post-Keynesians, and the radical political economists.
- 2) Following Cohen and Cyert (1975) and Dugger (1979), the terms model and theory are used as synonyms. Some have argued, however, that in the most correct sense, a model is a specific instance of a theory. See the discussion in Cohen and Cyert (1975, 18).
- 3) Many present-day institutional economists consider Commons, Veblen, Mitchell, and their contemporaries to be the "institutionalists" while viewing themselves as "neoinstitutionalists" (e.g., Gruchy 1969, 1975) just as the present-day "neoclassicals" consider the early marginalists (e.g., Leon Walras, Alfred Marshall) to be the "classical" economists.
- 4) This section draws heavily from Wilber and Wisman (1975), and Wilber and Harrison (1978).
- 5) There is a tiny group of modern day economists called Austrians that still adhere to the rationalist method. Some purely mathematical economists can also be considered rationalists.
- 6) In response to the criticism that many explanations in science are based on statistical laws instead of "general laws of nature," Hempel (1963) developed an inductive covering law model. Its logical structure is similar to that of the deductive covering law model except that the "general laws of nature" are replaced by statistical laws and initial conditions, and the explanandum is given as an inductive probability.
- 7) A partial bibliography of the extensive secondary literature generated by Friedman's essay is given by Boland (1979, 522).

- 8) Actually, De V. Graaf (1967) lists a total of seventeen descriptively inaccurate assumptions in neoclassical theory.
- 9) Cyert and Grunberg (1963) note that some natural science researchers, such as meteorologists, are like neoclassical economists in using the deductive covering law model of explanation and the ceteris paribus "excuse" when their models fail to predict correctly. However, they also point out that meteorological models (theories) are different from economic models (theories) because their "universal laws" (Ls) have been confirmed in disciplines outside of meteorology such as physics, whereas the "universal laws" of neoclassical economics have failed to be confirmed in disciplines outside of economics (psychology, for example).
- 10) Of interest is that two Nobel laureate economists: Herbert Simon and Gunnar Myrdal, acknowledge having had their thinking significantly influenced by John R. Commons. See: Simon (1979, 499), Myrdal (1978).
- 11) Samuels (1969) views institutional economics as the "conscious of the profession."
- 12) Some of the more well-known modern-day or neoinstitutional economists are Clarence Ayers, Kenneth Boulding, John Kenneth Galbraith, Wendell Gordon, James O'Connor, Kenneth Parsons, Michael Piore, Warren Samuels, Marc Tool, and Charles Wilber.
- 13) Of interest is that the professional organization for institutional economists is the Association for Evolutionary Economics. Also of interest is that, institutionalist models will often have an "evolutionary flavor" to them, in the sense that the term is used in biology. See: Boulding (1978) and Chase (1985).
- 14) The institutionalists extend this viewpoint beyond national boundaries by arguing that the world is really an evolving, goal-directed, socio-cultural-economic system that must be socially managed with an international plan. Instead of focusing on the interactions between the various "groups" within a single economy that have conflicting goals and are exploited or wield power, they study the interactions of countries (Third World nations, industrialized Western nations, etc.).
- 15) Fusfeld (1980, 29) argues that "Gestalt model" would be a more appropriate name for a pattern model because its concept is based on the fundamental premise of Gestalt psychology: "learning takes place by a process of integrating new ideas and information with other ideas and information in a pattern of relationships meaningful to the individual." Fusfeld is also uncomfortable with the notion that pattern models are only used for understanding while neoclassical formal models are only

used for prediction. He notes that, although this is true in general, it is really a matter of the amount of emphasis placed on understanding versus prediction. In other words, there is no reason why a pattern model cannot be used to predict nor why a formal, neoclassical model cannot be used for understanding. Finally, Fusfeld cautions against concluding that pattern models are devoid of any deductive logic because the pieces of the model must be logically weaved together.

- 16) According to Diesing (1971, 125), subjectivism "is the doctrine that only individuals are real, societies and groups are not, and therefore all explanation must be based ultimately on statements or laws about individual behavior."
- 17) For dramatic illustration of the type of rich insights that can be obtained only through the use of a socialized participant-observer, one need only turn to John Howard Griffin's 1957 book Black Like Me. This case study of the American negro in the deep South was undertaken by Griffin after he had his skin color chemically changed from white to black.
- 18) Diesing (1971, 200) does caution against the misuse of typologies through inadequate empiricism. He notes that stereotypes can occur when "types are treated as already completed and verified theories, rather than as tentative groupings useful for illuminating particular cases A person falls into the misuse of typologies when he has too much theory and not enough experience, and tries to make his theory substitute for the careful empirical study of cases."
- 19) Frey considers himself to be a "political economist" and has done extensive research into the "political business cycle." As a general rule, political economists utilize an institutionalist approach to economic analysis.
- 20) Many system dynamicists have already made this point. (See especially Richardson 1984).
- 21) Of interest here is a paper by Bell and Senge (1980) in which they argue that the practice of building confidence in models via subjecting them to a diverse series of tests causes the system dynamics method to be classified as a type of Popperian falsificationism.
- 22) For a well-written and succinct account of the writings of both von Bertalanffy and Boulding as they pertain to the evolution of the feedback concept see Richardson (1984, 183-196).

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