ECONOMIC RESEARCH REPORTS

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RR # 95-29 **September 1995**

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ABSTRACT

This paper is an analysis of a specific tradition of causal thinking in economics: the genetic-causal tradition. This was most self-consciously developed in the work of the Austrian School, but spilled over into other approaches. Genetic-causal explanations place emphasis, *inter alia*, on processes in time, emanating from changes in agents' desires and beliefs. The authors present a brief history of this approach, outline its major characteristics, differentiate genetic-causal explanation from other kinds of explanation, and illustrate the approach in mid and late-twentieth century economic theory.

JEL Classifications: B1, B2, B4

Keywords: genetic-causation; Austrian process theory; equilibrium

The authors wish to acknowledge the assistance of the C.V. Starr Center in making this paper available through its working paper series.

An integral part of the explanation of any phenomenon is an elucidation of the "chain" of causes and effects that led to its occurrence. In the philosophy of science literature in recent years there has been an extensive discussion of causation, especially as it pertains to physics, but also with regard to economics and econometrics. Our concern is not, except incidentally, with the several concepts of causation derived from this literature, but specifically with the idea of "genetic causation", a concept developed in the context of economics and, more generally, in the disciplines of human action. This approach was self-consciously developed in the writings of the Austrian School [Kaldor, 1934: 128]. Indeed, it in such writings that we dicover many nuances of genetic-causal thought. Nevertheless, as we shall see below, important aspects of this approach can be seen in many different variants of modern economic thought. What follows is largely an exploration and rational reconstruction of the hundred year old genetic-causal tradition, describing its philosophical underpinnings and its relevance for mid and late twentieth-century economics.

Historically , the genetic-causal view has emphasized three things which are worth mentioning here, and which will receive fuller treatment later. The first has to do with purposiveness. Economic agents act purposively—they have ends and find efficient means to attain those ends. Thus a fundamental feature of causation in economics concerns the causes of action, namely the desires and beliefs of the agents. The second aspect is that the actions of individual agents bear a causal relationship to overall market outcomes. While individuals may not always achieve what they desire, the interaction of their actions with those of others produces these outcomes. The final aspect emphasized is the genetic nature of a causal connection. On this view a cause is not simply something that always precedes its effect; it creates a unidirectional *process* the outcome of which is the effect.[1]

While we concentrate attention on the importance of discovering causal connections, we should emphasize here that noncausal models have made important contributions to our understanding of economic and social phenomena. Simple concentration on the determinants of an equilibrium configuration focuses the analyst's attention on the role of underlying factors in explanation. In the Paretian theory of consumer choice, for example, the roles of income, relative prices, and tastes are clarified without complicating matters by the introduction of

[1] While we do not believe that there is only one concept that has legitimate claim to being called "causation", we restrict our scope for several reasons. First, we seek to understand action and the genetic-causal tradition focuses on action. Second, genetic-causation emphasizes origins: how and why particular states come into existence. Origination is a real phenomenon in need of an explanation. Third, the real-world process of genetic causation can be distinguished from pure operations of the intellect like prediction or logical implication. The genetic-causal approach does not confuse ontic and epistemic aspects of causal connection.

consumer ignorance. Walras's system of general equilibrium reveals the interconnectedness of economic phenomena without needing to specify the means by which a particular interconnected state is reached. And the greater tractability of noncausal models is clearly an important advantage. Nevertheless, we will argue that noncausal explanations are insufficient, and attention to causal processes is a vital step in economic and social theorizing.

I. WHY CAUSAL EXPLANATION IS IMPORTANT

In the past twenty-five years physicists and philosophers of science have become increasingly convinced of the importance of causation in physical theories [Suppes, 1970: 5-6]. Nancy Cartwright made a sharp distinction between "the mathematical derivation of an effect" and "the causal process which produces the effect" [1985: 394]. Even a completely flawless and "realistic" derivation does not, in and of itself, provide us with a map of the process by which an effect is generated. It may point to those factors that are important in any such process but it cannot tell the causal story. This causal story is now considered a central aspect of explanation in physics [Cartwright, 1983: 74-99].

The older conception of explanation was formalized in the covering-law model of Hempel and Oppenheim [1948]. Under this model, a phenomenon is explained if it can be subsumed under a general regularity. From a general regularity, like the ideal gas law, a scientist can derive (or solve for) a particular instance of pressure if volume, temperature, and the number of moles is known. The derivation is not causal generation, however. The current desire to explain empirical regularities causally[2] renders the covering-law model inadequate as it suffers from the "problem of symmetry". A cause and its effect have an asymmetric relationship, but this cannot be extracted from a relationship that expresses only concomitant variation.[3]

The importance of causation has not achieved widespread recognition in economics and many economists echo Bertrand Russell's famous remark, later recanted, that the "law of causality...is a relic of a bygone age" [1912: 1].[4] (In fact Pareto [1971: 179] pre-dates Russell in a similar view by three years.) Friedman [1953], in an article that has influenced many economists' views of their discipline, argues that the reality of assumptions does not matter, and that successful prediction is the ultimate goal of economics. Thus, it is clear that if

[2] For arguments that causal explanation is an important goal of the hard sciences see Miller [1987], Salmon [1984], or Bunge [1979].

[3] Hempel made clear that the covering-law exhibits only Humean constant conjunction of events. "Now the assertion that a set of events ... have caused the event [E],... amounts to the statement that, according to certain general laws, a set of events of the kinds mentioned is *regularly accompanied* by an event of the kind E" [Hempel, 1965: 232, emphasis added].

[4] For Russell's implicit recantation involving the development of his theory of "causal lines", see Russell [1948: 333-350].

causation plays any role at all for Friedman, it is purely instrumental. In the older tradition of explanation as simply organizing data, Silberberg [1990:1] explicitly adopts the acausal covering-law model: wherein "'explanation' means that there is some more general proposition than the observed data for which these facts are special cases." And a recent mathematics-for-economists text [Weintraub, 1982: ix] draws a contrast between an explanation that rests on functional relations among variables and one that is causal.[5] The reader is told that the former is the method of economics.

The dismissal of causation in economics is problematic for two types of reasons. First, at a fundamental level, causes constitute an important part of the phenomena studied by economists. To abstract from causes is to abstract partially from the subject of the discipline. Second, attention to causes is of significant instrumental value in attempts to answer many of the specific questions economists pose. Causal analysis often enables us to go beyond explanations in terms of mathematical functions alone.

The assertion that causes constitute part of the phenomena studied follows directly from the foundations of modern economics. Economics presupposes agents who engage in purposive behaviour,[6] and further that this behaviour has important implications for the social world. Purposive behaviour consists of actions aimed at some goal. The goal pursued is determined by the desires of the agent, and the action chosen is determined by his beliefs about how to achieve that goal. Purposive behaviour, then, is behaviour *caused* by desires and beliefs, and economics is about the individual and social implications of such behaviour.[7] The essential causality of the subject-matter of economics can also be seen by considering the market phenomena analyzed by economists. In general these phenomena are not definable except in terms that incorporate the idea of purposiveness. The concepts of wages, rent, capital goods, wealth, involuntary or voluntary unemployment are all infused with purpose.[8] Thus any discussion of economic subject-matter must make at least implicit reference to the underlying causal structure of desires, beliefs and consequent purposes.

[5] Functional relations are sometimes *explained* causally. In this case the representation of causation is found in what the explanation *adds* to mere presentation of the functional relations. For a discussion of the idea that "causal relations are only weakly represented by mathematical functions" see Hausman [1983:58-9].

[6] "If anyone denies that men have interests or that 'we' have a considerable amount of valid knowledge about them, economics and all its works will simply be to such a person what the world of color is to the blind man. But there would still be one difference; a man who is physically, ocularly blind may still be rated of normal intelligence and in his right mind" Knight [1940: 12].

[7] Many economists throughout the history of economics have advanced this view. See, for example, Hayek [1955: 25-35], Knight [1940: 11-17], Mill [1974: 130-33], Mises [1966: 64], Morgenstern [1972: 702], Robbins [1969: 16;32], or Shackle [1972: 246]. For the contrary view that analytical technique, rather than subject-matter, is central, see Silberberg [1990:2].

[8] Wages are that which an employer gives his workers in exchange for ("for the sake of") the product they bring forth. A good is capital by virtue of how it is being used, namely, to produce other goods. See Senior [1962: 21], Hayek [1955: 31] and O'Driscoll and Rizzo [1985: 18].

Causal explanation also has instrumental value in producing clearer and deeper answers to many of the questions economists pose. These explanations divide themselves into two categories: those that render the overall explanatory structure more complete, and those that make it more nearly correct.

1. Completeness

A causal story that increases completeness provides a firmer foundation for the outcome produced by a noncausal theory. This can be seen in two ways. First, causal theories are necessary to explain what underlies the constant conjunction of events, such as changes in the money supply and changes in nominal income, and so provide the explanatory underpinnings of any prediction. We may, with several equations, be able to predict very well the relationship between money supply and nominal income. But without a causal interpretation of these equations, the predictive model is inherently incomplete, because it is likely to break down when circumstances change. Thus, any prediction is intellectually limited if we do not understand what makes the prediction come true. Second, a causal theory is required if we want to explain the origins of an equilibrium. Even the simple *ex ante* equality of supply and demand is not a self-explanatory state of affairs. The question "Why does supply equal demand?" is an important one, and is implicitly a request for a story about purposive behaviour. What causes people to act the way they do and how do those actions cause supply and demand to be equated?

2. Correctness

A causal analysis that renders the explanatory framework more nearly correct clearly provides greater insight into the phenomenon studied. This can be seen by examining the adjustment process and the impact that processes have on the character of equilibrium. First, attention to causal processes shows the possible importance of "frictions" as aids in the attainment of equilibrium—understanding the change from a situation in which supply is not equal to demand to one in which it is. For example, slowness of adjustment can, under certain circumstances, actually enhance the equilibrating tendencies of a system [Richardson, 1990: 39; Fisher, 1961]. Concentration on the equilibrium state alone leads us to think of frictions as mere obstructions.[9] Second, a causal story of adjustment determines which kinds of equilibria we can take seriously. Frydman [1982] for example, shows that when agents are restricted to the information they can plausibly acquire in the process of making and attempting to carry out their plans (a requirement of any acceptable causal model), they cannot

[9] See section VII–5.

learn the parameters of the rational expectations equilibrium-price distribution. This implies that for a large class of models convergence to rational expectations equilibrium will not take place.

The belief that behaviour is caused is implicit in almost all of modern economic analysis. Explicit attention to how those causes can and do operate, rather than simple use of them as a modelling vocabulary, improves and expands the foundations on which economics rests, and can provide better theory and theoretical predictions.

II. Two Kinds of Causes

We have associated causation with change. This needs elaboration, as there are at least two types of causes that have been treated in the literature of economics. The first, *sustaining causes*, address the maintenance of an equilibrium state of affairs, and are thus perfectly at home in a changeless universe. The second, *originating causes*, are those factors responsible for the origin or coming-into-existence of a phenomenon. Sustaining causes explain states; originating causes explain events or changes.

1. Sustaining Causes

These focus on a particular state after it has come into existence but before is goes out of existence. Sustaining causes simply maintain a certain state of affairs. Consider, for example, the role of economic primitives (tastes, technology, resources) in maintaining a general equilibrium, so long as they themselves remain unchanged. Similarly, in a partial equilibrium framework the consumer's bundle of choices is sustained by his tastes, the existing vector of relative prices, as well as other factors in the relevant *ceteris paribus* clause. All of these determinants have some claim to be called "causes" insofar as there is an asymmetric relationship between them and their putative effects. Thus the general equilibrium of endogenous variables does not itself affect the "endowed" tastes, technology or resources; a particular set of consumer choices affects neither tastes nor (appreciably) the prices of related goods in a Marshallian partial equilibrium. Sustaining causes are these unidirectional determinants that maintain an equilibrium state of affairs.

2. Originating Causes

Genetic causation, however, is concerned with why and how a certain phenomenon or state of affairs comes into existence (its "genesis"). For example, Eugen von Böhm-Bawerk's concern was with the "originating causes" of interest whereas in his view Irving Fisher focused on those factors that mathematically determine or sustain a certain interest rate. [Böhm-

Bawerk, 1959b: 191-2].[10] The aim of the genetic-causal approach is to exhibit "how prices come into being rather than what system of prices will secure equilibrium" [Kaldor, 1934: 128]. More generally, genetic-causation is concerned with the process by which a phenomenon comes about—the changes necessary to bring the phenomenon into existence.

Some economists have sought to construct a bridge between analysis in terms of sustaining causes and that in terms of originating causes. Fritz Machlup [1967b: 150] believed that economics is not concerned with explaining states but with explaining changes. Thus he thought that the purpose of elucidating sustaining causes is to explain change through comparative-static manipulation of the equilibrium construct in which the sustaining causes are embedded [1967a: 44]. The economist seeks to understand a rise in apple prices by focusing on the disturbing change(s) that brings it about, such as an increase marginal cost. The economist cannot really explain the current *levels* of apple prices and quantities. This is because the simple theory of the profit-maximizing firm abstracts from many of the complex factors involved in the real world of firm decision-making and hence in the determination of market outcomes. Without explicit knowledge of these factors and how they influence outcomes, we cannot explain levels. Assuming the factors from which we abstract are constant or change relatively slowly, however, we can explain the direction of adjusting changes. The equilibrium construct is thus an analytical apparatus whose function is to explain the causes of change (or to provide theoretical predictions of the effects of changes).

In a related argument, Hausman [1990] argues that supply and demand analysis, often seen in terms of what we call sustaining causes, can be used more generally—a change in the supply curve can be the external cause of a change in equilibrium prices and quantities. A weather shock, say to the coffee bean harvest, shifts the supply curve, and a new price emerges. The *ceteris paribus* clauses allow us to assign a causal ordering to the model and assert that the shift of the supply curve caused the new price. It should be pointed out, however, that throughout this argument, a market process is working: "the explanatory factors reduce to the old demand curve, the shifted supply curve and the unspecified market mechanism" [177], and the "market mechanism somehow increases the price of coffee until the amount demanded equals the amount supplied" [176]. Without a belief that some process can and does lead the economy to the new equilibrium, the explanation will not work as a *causal explanation*. We cannot distinguish between a causal connection and a single coincidental or spurious succession without at least a vague or implicit idea of the process between the two events.[11]

[10] Concerning Böhm-Bawerk's analytical technique, Schumpeter [1954: 908, n.47] said: "Any truly 'causal' explanation had to be 'genetic'. It had to uncover the (logical) origins of things."

[11] "When discrete events bear genuine cause-effect relations to one another—except, perhaps, in some instances in quantum-mechanics—there are spatio-temporally contiguous causal processes joining them" Salmon [1980: 55].

Thus Hausman points out that "partial equilibrium explanations [such as the above] differ from paradigm cases of causal explanation since they abstract from the actual sequence of events and the causal relations in that sequence" [171].[12] While it may be possible to use sustaining-cause analysis to think about changes, a causal process is central to the connection between a change and its effect.

While not all economists accept the view that the *only* function of equilibrium theory is cause-and-effect analysis, many economists typically use the theory in this way. Thus uses of equilibrium are implicitly or explicitly bound up with causal processes.[13] Few economists would deny that the coherence of a comparative static exercise requires at least an implicit process. This is why undergraduates are told stories about an increase in demand resulting in the "bidding up" of prices. Even in more formal theory, the Walrasian tradition found it was necessary to introduce the fiction of the auctioneer to explain the determination of prices; and Edgeworth similarly resorted to the process of re-contract. Our ability to abstract from processes is dependent on the validity of the assumption that adjustment paths do not affect the configuration of the new equilibrium. This would mean that we can successfully predict the equilibrium on the basis of change in the "data" alone. If, however, we wish to *understand* how the new equilibrium comes into existence we must make reference to the underlying changes in desires and beliefs. Furthermore, many economists argue that the assumption of the irrelevance of adjustment paths is often mistaken. Paul David [1985, 1988] argues that "history is important"; Franklin Fisher [1983] shows that if disequilibrium trades take place, the final equilibrium cannot be deduced from preferences and initial endowments, but is dependent on the order and nature of these trades.

In summary, the genetic-causal tradition focuses on the explanation of change through originating causes and adjusting processes.

III. GENETIC CAUSATION IN THE HISTORY OF ECONOMICS

Any discussion of the history of causal ideas in economics must distinguish, first, between causation at the level of individual decision making and causation at the level of the market process. The former refers to the cause of a particular decision or action while the latter refers to the sequence of decisions that cause overall market outcomes. While these two levels are clearly related, there are important differences stemming from the fact that market

[12] This abstraction is legitimate only to the extent that "the adjustment process has little affect on the final outcome." [Ibid.]

[13] It should be noted here that Machlup's equilibrium-causal analysis [1967: 47] includes an intermediate step that portrays the adjusting changes before the final position is reached: "[W]e must proceed with the sequence of adjusting changes until we reach a situation in which...everything could go on as it is...a 'new equilibrium'"[Ibid.: 48].

outcomes are often the unintended consequences of individual actions. We must also distinguish between instantaneous links between cause and effect, and temporally-extended causal processes. The latter are critical in the genetic-causal approach as it has historically developed.

1. Causes at the Individual Level

The genetic-causal explanation of individual decisions receives an early self-conscious expression in the work of Böhm-Bawerk. In his elaboration of the theory of value, Böhm-Bawerk asserted that "There cannot be any doubt that there is a causal relationship between the importance of the end and that of the means." In an implicit attack on the idea of mutual determination of equilibrium values, he pointed to a causal asymmetry: "[I]t is the end that lends means its importance, not vice versa." Thus the "value of consumers' goods or products, has causal priority over that of producers' goods"; the two are not mutually determined [1959a: 111]. Producers' goods come into being for the sake of consumers' goods; consumer's goods do not come into being for the sake of producers' goods. This viewpoint was extended and more fully developed as the foundation of *verstehende* social science by Max Weber who put the essential point succinctly: "[P]urpose is for [agents] an imagined end which becomes the cause of an action" [1922: 183][14].

Largely because of Weber's tremendous influence among German-speaking intellectuals, the idea of purpose-causation spread beyond the Austrians to the twentieth-century German institutionalist economists, particularly Werner Sombart. For Sombart [1930: 225] motives are the ultimate causes of human action, and to explain a complex social phenomenon causally is to trace it back to the motives that generated the action which in turn generated the phenomenon. Social phenomena are thus the products of "act causality". Unlike Böhm-Bawerk, however, Sombart often stressed collective, rather than individual motives.

Finally, it should be noted that genetic-causation played an important part in many of the writings of J.M. Keynes, who often stressed "motives, expectations, [and] psychological uncertainties" as the source of motion in economics.[15] In a 1938 letter to Roy Harrod, Keynes

[14] The translation is by Ludwig M. Lachmann [1971: 33].

[15] Keynes argued that the beliefs of individuals almost always skim the surface of reality. The true, underlying cause (*causa essendi*) of a market-level phenomenon is unknown. Accordingly, when an individual acts he must rely on a probable hypothesis or ground (*causa cognoscendi*) and the practical, rather than deductive, certainty it provides. Since beliefs are based on these superficial causes, they are often likely to be wrong. Furthermore, in the absence of knowledge of the *causa essendi*, it is often reasonable for individual actions to be based on conventional opinion. See Fitzgibbons [1988: 18; 81].

said that if physics were like economics it would be "as though the fall of the apple to the ground depended on the apple's motives..." [1973: 300].

2. Causes at the Market Level

Causation at the level of market processes was a key element in the classical conception of competition. This was, first and foremost, rivalry, and not a set of equilibrium outcomes [McNulty, 1968]. Individual sellers would cut prices below those charged by their competitors, and individual buyers would outbid others eager to purchase the same good. Rivalrous motives are thus essential to understanding this process. On a more aggregated level, the classical inter-market process was propelled by capital movements in response to changes in the industry rate of profit. In the short run "market prices" (determined by supply and demand) can deviate from "natural prices" (determined by the cost of production). When this happens, the profit rate in the affected industry deviates from the profit rate in the lead sector, agriculture. Competition for scarce capital ensures that it enters industries in which the market price exceeds the natural price and in which, consequently, profits are temporarily higher than in the lead sector. These underlying causal processes justified viewing the state of equilibrium as a centre of gravity toward which the system, continually in motion, was always moving.[16]

3. Interaction of Individual and Market

Carl Menger, the founder of the Austrian School, inquired about the causes of "progress" or, more generally, change. He located these causes in two major factors: desires ("needs") of the agents, and beliefs ("knowledge") about the relationship between physical objects and the satisfaction of desires [Menger, 1981: 52]. Menger endeavoured to show how the interaction between needs and knowledge was the source of motion in an economy. Later Böhm-Bawerk focussed his concern about causation mainly on value theory. Unlike Menger, Böhm-Bawerk did not link causation to processes. He was content simply to identify a cause in the appropriate motive of the individual, and did not trace out the process by which a market outcome was generated. On the other hand, the classical economists dealt to a much greater extent with causal processes operating in the market, but neglected any explicit development of causes at the level of the individual. In his concept "genetic-causal equilibrium," Hans Mayer [1994] sought to combine more explicitly causation at the level of

[16] Ultimately, it was concentration on the results of the competitive process that led away from concern with causal processes. Cournot, for example, concentrated on the state of affairs that emerged when "the effects of competition have reached their limit..." [1971: 90]. And Ricardo admitted a similar tendency when he said in an 1817 letter to Malthus, "[Y]ou have always in your mind the immediate and temporary effects of particular changes, whereas I put these immediate and temporary effects quite aside, and fix my whole attention on the permanent state of things which will result from them" [1887: 127]. The Cournot-Ricardo approach came to dominate the later formalization of the theory of (perfect) competition. On the importance of processes in the genetic-causal tradition, see Sec. III-3 and 4 below.

the individual with causation at the level of market processes. He also sought to integrate this causal analysis with the Ricardian concern for equilibrium [Ricardo, 1887: 127].

Mayer argued that Pareto's economics was "functional price theory", the task of which was to derive mathematically the character of an equilibrium from the given data. Mayer, by contrast, was interested in the sequence of decisions that constitutes the causal path by which an equilibrium could be reached. This sequence would reflect the individual's beliefs as they are continually changed by his experiences in attempting to adjust efficiently to an external reality. As the individual learns more about his environment he approaches ever more closely an equilibrium adjustment, even if that equilibrium is not implicit in the original data. Mayer wanted to explain how this permanent state can be generated by a transient market process, that is, he wanted to find the laws of "being" (equilibrium) in the laws of "becoming" (processes) [Mayer, 1994: 149]. By his own admission Mayer did not get very far, but he thought the task was an urgent one. A general theory of the path continues to elude economists in this tradition.[17]

Friedrich Hayek [1948a, b] further developed the genetic-causal approach by conceiving the market as a process of acquisition and transmission of knowledge. The central problem is to show how a state of equilibrium can be achieved starting from a position of disequilibrium. Equilibrium obtains when the plans of individuals are mutually compatible, that is, when they can all be carried out. Since plans are caused by the desires and beliefs of individuals (about the external world and about what others are planning to do), mutual incompatibility arises when some beliefs on the part of some individuals are false. The series of actions leading to belief-correction is the cause-and-effect process that can generate an equilibrium. More specifically, the causal market process consists of the acquisition and diffusion of knowledge. Agents acquire knowledge both about what others are planning and about the objective, external world, and this knowledge is diffused among individuals. Changes in beliefs continue until all plans are compatible, that is, until there is an underlying equilibrium of beliefs. This equilibrium, however, can be very different from anything the individuals may have intended to bring about. While the ultimate results of a market process are generated by the desires, beliefs and consequent intentions of market participants acting in a competitive environment, they are "the results of human action but not of human design" [Hayek, 1967]. Nevertheless, this process is rarely one which significantly affects the data implicit in the original equilibrium.

[17] See Lachmann [1986: 108-38] for a different attempt to go beyond Mayer.

4. Causal Market Processes and Time

As we have seen, the genetic-causal method does not simply involve the pairing of causes and effects. Moreover, each of these events is connected by a process that is extended in time, and sometimes also in space, rather than by an instantaneous link. Menger understood this as early as 1871: "The idea of [originary] causality ... is inseparable from the idea of time. A process of change involves a beginning and a becoming, and these are only conceivable as processes in time" [1981: 67]. The fundamental reason for this, as we see it, is that one fundamental aspect of causal interactions at the market level is learning, both about the external world, and about the desires and beliefs of other market participants. This learning cannot be instantaneous for two reasons: The human mind has neurological limitations in its apprehension of the world; and agents must signal their desires and beliefs by actions, which are also bound by neuro-muscular limitations. Learning, practically speaking, is always extended in time and therefore so must be causal processes. In developing his expectational approach to monetary equilibrium, Myrdal invoked "causal developments" the "most essential quality" of which "is that they *take time* and that even the *time order* in which they occur is decisive for the outcome" [1939: 44-45]. Therefore, while causal asymmetry and temporal asymmetry are not identical, in the genetic-causal approach processes and the passage of time are intimately related.

IV. ELIMINATION OF INTERNAL CHANGE AND GENETIC CAUSATION

Causes are events or changes in the pre-existing state of affairs that produce other changes, called effects.[18] If there is no change in a system, then *ipso facto* there can be no causation.[19] Much current thinking, focussing on equilibrium and thus on sustaining causes, implies the elimination of change. This statement refers not to change in entities like GDP or prices, which undeniably go up and down, even in equilibrium models, but rather to changes "at the appropriate level of analysis". In equilibrium, plans are coordinated and expectations are fulfilled, so the forces promoting change in one direction are exactly offset by forces promoting change in the other. At the level at which equilibrium is defined, therefore, there can be no change.

Consider typical responses to two apparent disequilibrium phenomena, in which it seems that change should occur. An agent buys a newspaper and finds that the value of information in it is not worth the purchase price. Are we observing an agent whose reservation price is incorrect; should he revise it downward? No, because in fact a newspaper is

[18] Henceforth, we use "cause" to refer to originating or genetic causes, unless otherwise noted.
[19] There may, of course, be latent causes or a causal structure that does not manifest itself.

a lottery ticket—sometimes the payoff is high, sometimes low, and in equilibrium, the expected payoff is exactly equal to the reservation price. Equilibrium must be defined in terms of expected values. Similarly, we occasionally observe agents revising predicted prices in view of new information. The analyst realizes, though, that the agent in fact had a set of conditional predictions and is simply activating the prediction associated with the realized conditions [Hahn, 1984]. Here, the equilibrium should be defined in terms of these conditional distributions. When this is the case, agents do predict the "changes" they experience, and with the right probability. But as rational expectations makes clear, predicted changes will already be incorporated into agents' plans. Thus the system, or underlying structure of beliefs will not change. The move in economic analysis from point expectations to more general distribution expectations, asserts that agents parse the world not into single events but into ensembles (or virtual ensembles) of events. Thus to examine a situation in isolation, it is argued, is an error. Both the economic analysis, and the equilibrium are at the level of the framework, and *in terms of that framework*, there is no change and so no originating causation.[20]

In general, on the appropriate level of analysis, when the world is "parsed correctly" by the analyst, agents in equilibrium change neither beliefs, actions nor plans. All events are predicted with the appropriate probability, and all actions are simply the working out of well-laid plans. The equilibrium approach can be characterised as the search for the level of analysis on which these statements are true.

An extreme version of this approach is found in Reder [1982: 12] who describes the Chicago position as assuming that "one may treat observed prices and quantities as good approximations to the long-run competitive equilibrium values" even when missing markets are taken into account. Many of those who disagree with this position and call these situations "disequilibria" really think of them as simply non-market-clearing or non-Walrasian equilibria [Benassy, 1987: 859]. In neither view, however, is there any question of endogenous change; there is simply disagreement over the nature of the equilibrium state.

The focus on equilibrium conditions can be successful in describing why a particular equilibrium is sustained, but has great difficulty explaining how and why it comes about or originates. Originating causes must be events; they cannot be states.[21] Events, in turn, are

[20] "Change" must be defined as "any divergence of the actual from the expected development, irrespective of whether it means a 'change' in some absolute sense" [Hayek, 1948a: p. 40]. When the "change" is the absence of some expected occurrence, the relevant event would be a revision, on the part of the agent, of his view of the facts of the world. External change is "genuine" to the extent that it is unpredicted because only the unpredicted gives rise to changes in belief. Such changes in belief are the events that can generate a new plan.

[21] If an originating cause were a state, there would be no reason why the effect does not occur at the inception of the state (what would be holding it back?), but this would imply that the cause is not the state, but the initial occurrence of it, that is, an event.

changes so the focus on situations and entities that do not change eliminates the possibility of originary causation. From the equilibrium perspective, the causal process by which an equilibrium originates is of little interest in its own right; it is simply a carrier and, in the most extreme expression of this methodology, it is completely arbitrary.

It follows from this methodological approach that to the extent that equilibrium economists discuss causes, they look for exogenous factors. All effects are caused by things external to the model (economic primitives) such as endowments, and, until recently, technology and institutions. (In a partial equilibrium model, the "primitives" also include changes in other markets.) A change in any of these primitives may cause a change in the equilibrium, but such changes are just exogenous shocks. What this view resists is the fact that there are intervening events between a change in primitives and the resulting change in economic variables, and that these intermediate events, such as changes in agents' perceptions or beliefs, are properly called *internal* causes.[22] Further, these causes, quite apart from any changes in the primitives, may be central in determining the final outcome. Under these circumstances the analyst will not be able to deduce the final equilibrium from the primitives alone. The path will matter.

All changes in the external world, such as changes in economic primitives, must pass through the human mind before affecting human action. Thus internal causes—changes in desires or beliefs—occupy a special position when we are discussing the causes of actions, and thence of market processes. Suppose, for example, the quantity of a resource has exogenously increased but, for some reason, this remains unnoticed by everyone. Economically, it will be as though the quantity had not changed; actions and market processes will be unaffected. On the other hand, suppose that all agents failed to notice a reduction in the availability of the resource. All agents would attempt to engage in the same actions as before, ultimately to be frustrated by the physical impossibility. Thus at least some of the agents will begin to change their actions. The explanation of why some will now engage in successful action while others continue to be frustrated will run in terms of the presence or absence of appropriate changes in beliefs.[23]

[22] An *internal cause* can be either a sustaining cause or an originating cause.

[23] It is no doubt true that for some purposes we may legitimately abstract from the desires and beliefs of agents. Consider the case of formulae that are useful in analysing traffic flows. These formulae omit any explicit reference to the desires or beliefs of automobile drivers. Nevertheless, at a deeper level one could not explain *why* the formulae work without an explanation in terms of internal causes. It will also be the case that when the formulae break down (as they will in unusual circumstances) this will be inexplicable except in terms of changed desires or beliefs.

V. CHARACTERISTICS OF GENETIC CAUSATION

For economics there are two principal overlapping aspects of genetic-causal explanation: purposiveness and genetic connection. In this section we examine these more closely by elucidating several important characteristics of causation that are associated with each aspect. These characteristics are not a loose collection held together by various accidents of intellectual history, but are related to each other in two fundamental ways. Some are reflections of the empirical reality of desires and beliefs, that is, they are the simple facts of intentional causation.[24] Others are further characteristics implied by the initial facts. Together they form a coherent system of causation relevant to economic phenomena.

1. Purposiveness.

Economic agents have ends—to maximize utility, or to maximize profits—and they endeavour to adopt means that will achieve these ends. Economics, in an important sense, is a science about action. In modern action theory, philosophers have emphasized the importance of *desires* and *beliefs* as the causes of actions [Davidson, 1968].[25] In order to understand the causes of an action, one must understand what the agent was trying to achieve, and what he thought the facts were. More recently action theorists have extended this fundamental idea to the context of intertemporal decision-making wherein desires and beliefs cause individuals to form plans, the execution of which have their own causal repercussions [Bratman, 1987].

(i) A cause is a real mental event or change.

Desires and beliefs are causes of actions. An agent forms a plan based on his current desires and beliefs, and if these do not change, he carries out that plan. A cause then, can actually produce a sequence of actions, all of which will be part of the plan. It is important to note, though, that without *changes* in desires or beliefs, an action cannot originate. A desire *comes into being* and the agent acts for the sake of satisfying it. If the act is successful the desire is extinguished, at least for a time. Two things are worth noting here. First, if the desire works through an extended plan, provided the desire does not disappear, many different actions may be performed, thus giving the impression that a state causes change. In this case, however, the *initial* appearance of the desire caused the origination of the plan which entailed the many different actions.[26] Second there is a distinction between a simple static condition

[24] It is true that there are many facts of intentional causation, and the genetic causation consists of a certain selection from them. Those selected are ideally the ones most useful in understanding economic phenomena.

[25] The view that desires and beliefs can be causes dominates the philosophical literature, but see O'Sullivan [1985:234-36] for a criticism of Davidson.

[26] The continued presence of the desire may be necessary for the sequence of actions to be undertaken, but its original appearance is what generates the plan resulting in the action.

(an agent is hungry) and the continual recurrence of a condition (an individual gets hungry every day). Static analysis of essentially dynamic problems tends to collapse the latter into the former. Thus, strictly speaking, only changes in desires and beliefs can be originating causes of actions. When we speak more simply of desires and beliefs as causes we are looking at them as having already come into existence and now simply doing their work.[27]

The genetic-causal approach emphasizes that desires and beliefs are also real, and not fictitious entities with only instrumental value. Such realism was already evident in the work of the second-generation Austrian, Friedrich von Wieser. In Weiser's view the layman knows the essence of the theory of value from his own experience. The economist's understanding differs only insofar as he grasps the matter "theoretically" or generally rather than simply practically and in concrete circumstances. The reflective layman is the "final judge" of the theory in the sense that he must recognize "himself in a description which informs him about his own life and being" but "which he himself is incapable of giving" [1893:5-6]. Thus in this approach one is not free to attribute arbitrary desires and beliefs to agents, or to view them as solving problems of arbitrary degrees of complexity, simply to fit the postulated model to the statistical data. More recently, Uskali Mäki [1990, 1993] argues that the genetic-causal tradition, especially in its Austrian variant, is committed to a form of scientific and common-sense realism. The mental entities of desires and beliefs exist objectively, that is, they exist independently of their recognition by economists.[28] This is related to a point argued by Nancy Cartwright [1983: 74-99], namely, that to accept causal explanation is to accept the reality of causes. If one accepts an explanation of the form "*X* causes *Y*" and if *Y* is a real event, then one is committed to the view that *X* is a real event. If the statement "*X* is a real event" were not true, how could *X make* the statement "*Y* is a real event" true? Causal explanations refer to events that bring other events into existence or make their existence true. (Predictive laws, on the other hand, do not make their predictions come true.) To engage in causal explanation is to assert the reality of the causes.[29] In the context of economics, the point of causal explanation is to understand how real desires and beliefs are related to individual actions and thence to market outcomes.[30]

[27] For an analysis consistent with the above, see Davidson [1968: 88].

[28] Mäki is quite aware that there are many different variants of scientific realism. To say that a theory is realistic does not necessarily commit one to the view that *all* of its theoretical entities exist. A scientific realist "may think that all, or most, or only some scientific objects exist" [Mäki, 1990b: 314]. To deal with the precise extent of "realisticness" in genetic-causal economics is beyond the scope of our study.

[29] This statement does not represent the subtlety of Cartwright's view of causation, merely one aspect of it that is consistent with Mäki's [1993] view.

[30] John Searle [1984: 67] elevates a very strong version of this idea to a principle of the social sciences (Principle 6): "The explanation of an action must have the same content as was in the person's head when he performed the action or when he reasoned toward his intention to perform the action. If the explanation is really explanatory, the

...

(ii) Intentional causation is forward-looking.

The generic purpose of an action is to alter the future state of the world relative to what it would have been in the absence of the action. Consequently, the desires and beliefs that constitute the causes of action are future oriented. A complex causal event is an imagined or expected future goal (desire) in conjunction with an action or plan for its attainment (belief). Any belief that results in a plan must be founded on expectations about the state of nature and actions of other people. Thus, to describe the genetic-causal method as exhibiting "a unilateral dependence of the succeeding event on the preceding one" [Hayek, 1942: 17] is potentially misleading. The impression given is of a backward-looking causal chain beginning with past decisions and moving to current decisions. In the realm of human action, however, the *source of motion* is the imagined future that the individual is trying to attain. The past, on the other hand, is the source of constraints on that motion. Previous decisions change the options among which individuals can choose.

(iii) A cause need not be necessary or sufficient for its effect.

Some philosophical traditions claim that a cause must be either a necessary or a sufficient condition (or both) for the occurrence of an effect. In recent work [e.g. Miller, 1987], however, this requirement has been rejected as too restrictive. Whatever the merits of the newer view for the natural sciences, it seems to characterize genetic causation accurately for economics. No unique combination of desires and beliefs is necessary to generate a given action.[31] The same action, for example, may be an appropriate response to a multitude of desire-belief combinations. Similarly, several different actions may be appropriate responses to a particular desire-belief combination—the desire-belief combination does not necessitate any *particular* one of them. Rejection of the necessity-and-sufficiency view of causation entails the acceptance of two propositions: first, that a given effect can have more than one cause; and, second, that a given cause can have alternative effects. It may appear that the regularity of causal connection is threatened by this view. Two things should be noted, however. First, rejection of necessity and sufficiency does not imply that a given effect can have any cause or that a given cause can have any effect. The sets of possible causes and possible effects are

content that causes behavior by way of intentional causation must be identical with the content of the explanation of the behavior."

[31] Some philosophers, notably J.L. Mackie [1965: 248; 251], have argued that causes are necessary *in the circumstances*. In other words, adapting Mackie's framework to human action, given the actual belief that people held, a particular desire was necessary to produce the effect. Thus, the desire was a necessary *part* of a complex condition (say, desire and belief) that was sufficient for the effect. Nevertheless, it is crucial here to distinguish between causation of a singular event and causation of the general type of event of which the former is an instance. It is quite possible for a factor to be necessary in the explanation of one particular event but not in the explanation of another event of the same type (where "type" is defined by a theory). We have no quarrel with this concept of necessity.

circumscribed by the relevant theoretical frameworks. Second, the genetic-causal approach is not fundamentally based on regularity but on intelligibility. Just because, for example, there are many reasons an individual may go to France, it does not follow that the relation between any of these reasons and the action is less intelligible, Similarly, just because there may be many ways, under given conditions, to produce a specific output, does not mean the way actually chosen is less intelligible.[32]

2. Genetic Connection between Actions and Market Outcomes.

Simply listing causes and effects side-by-side is not enough for a causal explanation. There must be some process that links desires to market outcomes. If we could be assured of the immediate satisfaction of all desires and immediate validation of all beliefs, there would be no need of establishing a genetic connection. We could simply show the consistency of desires-beliefs and outcomes. Processes connecting cause and effect consist of three stages: (1) making plans that are compatible with one's desires and beliefs; (2) possibly discovering errors in these plans through unsuccessful attempts at implementation; and (3) revising plans in response to the discovery of error [Bode, 1943]. A process will end if all agents are able to eliminate errors from their plans, and so an equilibrium occurs.

(i) A cause must be external to its effect.

If an effect is the result of a process which flows from a cause, it is clear that an effect and its cause(s) must be distinct. They must at the very least be separated by the process. An event or state cannot be (part of) its own cause. If human action is the cause of an equilibrium, then it cannot be that this same equilibrium existed prior to the action. One cannot claim that an equilibrium is caused by a series of actions and postulate as well that the equilibrium exists when the actions get under way.

This observation points to an important feature of economic action. If processes start outside of equilibrium, agents will not try to charge the equilibrium price (or more generally engage in equilibrium behaviour), they will presumably try to charge the profit-maximizing

[32] Economists have often modelled reality such that there is only one optimum or equilibrium outcome relative to a given set of data. Nevertheless, there is little reason to believe that the world *must* be so modelled. Indeed, recent work (especially in game theory, industrial organization and macroeconomics) has produced models in which there are many equilibrium outcomes from a given set of data. One common response to the multiple equilibria phenomenon (often used) is to re-define the equilibrium concept in order to reduce the number. This is the route taken in the refinements literature in game theory. It is not clear *a priori* that the number of equilibria should be reduced, but a very strong argument for eliminating one or some of the possible equilibria is that the agents in the model could not sensibly engage in a process that would produce that equilibrium.

price.[33] The interesting problem is to find the conditions under which the cause (trying to charge a profit-maximizing price) generates a process the effect of which is an equilibrium.

(ii) A cause bears an asymmetric relation to its effect.

A fundamental feature of a causal relation is that it is not symmetric: a cause generates its effect; an effect does not generate its cause. In the genetic-causal tradition this asymmetry is rooted, as we have seen, in the unidirectionality of purposiveness. "It is the end that lends the means its importance, not vice versa" [Böhm-Bawerk, 1959a: 111]. It is also present in the genetic connection between acts and market consequences. Transactions produce or generate equilibrium prices, and are not mutually determined, as it appears in the mathematics of general equilibrium models.[34]

(iii) A cause need not produce its intended results.

Although desires and beliefs are the constituent elements of intentional causation, it does not follow that all effects, especially at the level of aggregate market outcomes, are intended. We must therefore distinguish between the "consequences of intention" which are ubiquitous in genetic-causal theories, and "intended results" [Mäki, 1990: 325]. The attempt (or plan) to purchase apples on a market in which there is zero excess demand manifests itself in purely intended results, that is, the intended quantity is actually purchased at the intended price. On the other hand, the attempt to purchase on markets in disequilibrium or actions under prisoners' dilemma circumstances will each manifest themselves in unintended results (although the relevant individuals' behaviour is itself based on intention).

(iv) A genetic connection is a nondeterministic process in time.

The distinction between processes and a series of states was elaborated by Henri Bergson [1975: 3-27]. It is not possible, Bergson argued, to replicate the motion of an arrow through the air by a succession of stills or snapshots of the arrow along its path. The arrow does not get to its destination simply by *being* at a different location at different instants in time; it must move. A process cannot be represented with a series of equilibrium or rest states. An attempt to do so would be unable to explain why the system leaves any of its intermediate

[33] Wicksteed [1967: 221-26] argued that outside of equilibrium the profit-maximizing strategy for the agent is to charge what he thinks is the equilibrium price. This follows, however, only if the agent assumes that the prices charged by others will be at the presumed equilibrium point. If this is the case, it is hard to imagine why the market is not *already* in equilibrium. On the incompatibility of perfect knowledge and a causal process of equilibration, see section VII-5.

[34] In the lore of general equilibrium theory, according to Walras and Edgeworth, equilibrium prices generate transactions and not vice versa. In Walras's analysis the auctioneer ensures that actual trades take place only at equilibrium prices. In Edgeworth's analysis the ability of agents to recontract also ensures the absence of actual trades at disequilibrium prices. In neither case do *actual* transactions generate equilibrium prices.

states, since they are equilibria. One solution is to appeal to a series of unrelated exogenous shocks to which the system adjusts instantaneously. The alternative, as we shall see below, is to include a principle of internal change by which any given phase of development contains the unspent potential for the next phase. A process, then, will exhibit dynamic continuity, that is, a linking together of memory, present action, and anticipation.[35]

With economic agents this link can be found in the idea of a plan,[36] in conjunction with an hypothesis about the formation of expectations. "[P]lans are made [now] for the attainment of certain aims...and...they are based on individual expectations concerning future conditions, expectations which in turn are influenced by individual interpretation of past events" [Lindahl, 1939: 36]. When an individual's plan fails, in the sense that it cannot be wholly implemented or that it produces unexpected bad results, he will typically attempt to revise it. Exactly how he revises it depends in part on what he expects the future to be. Since interpretation of the past and expectation of the future are ultimately related, plan revision is dynamically continuous.[37]

The connection between plan revision and objectively-described past events is non-deterministic. Even where an event occurs in the lives of many individuals, it will not necessarily be interpreted in the same manner by all, due to the heterogeneity of the experiences of the event. Yet even where the historical experiences and interpretations are the same, the individuals' new beliefs (expectations) need not be identical. There are no uniquely correct inferences about the future that can be made from any body of past data; the theories that people hold, which form the basis of these inferences, are generated from a large stock of more remote heterogeneous experiences and knowledge rather than from homogeneous immediate memory. Finally, even if the new beliefs are homogeneous, there is often no single course of action that must rationally be undertaken to attain a given end. For all of these reasons it follows that plan revisions are not uniquely related to any given body of "objective data". In this sense they are nondeterministic.[38]

[35] This is because the current memory of the past affects the individual's apprehension of the future. Thus the growth of knowledge over time takes place in a temporally integrated manner. This is a theme of Bergson's *Matter and Memory* [1978].

[36] A plan is a consistent and integrated series of actions intended to be implemented over time. Facts about the external world will be reflected in a plan since the causes of action must pass through the filter of the mind. See text at and around footnote 22 for a discussion of internal causes.

[37] Dynamic continuity is to be contrasted with mathematical continuity, which is infinite divisibility. See Čapek [1971: 90-91]. Furthermore, while continuity is also found in the fact that, say, physical capital has a positive lifetime, this fact must be mediated through the plans of agents before it has economic effects.

[38] An ex post reconstruction of a non-deterministic process is built upon the premise that "some events that occur are not the only possible outcomes of their antecedent conditions but instead occur as one among several outcomes within a fixed set..." [Fetzer and Almeder, 1993:38]. They immediately add "in accord with probabilistic laws." This additional requirement is unnecessary. See Thorp [1980: 131-137].

In addition to dynamic continuity and indeterminism, the temporal characteristic of a genetic connection is based on intertemporal lags. Since agents do not apprehend everything at once, learning takes place over time. While frustration in the implementation of a plan may happen "now", the individual may not be able to correct all of his errors right away. Furthermore, even when complete knowledge is eventually acquired, full adjustment of plans to that knowledge may not make economic sense. Previous actions almost always constrain current actions. A factory of a certain suboptimal design, for example, need not be abandonned immediately (it may only require some modification) even if later, when it wears out, it would not be rebuilt. Thus a genetic connection is never an instantaneous relation but a temporally coherent, yet nondeterministic, process of *gradual* error correction and plan revision.

VI. FUNCTIONS, PREDICTION AND LOGICAL IMPLICATION

In both the philosophical and economic literature, causation has frequently been identified with the concepts of functional dependence, predictive capacity, or logical implication. These ideas have persisted because there often *is* a connection between genetic causation and these concepts. Functional relations can be interpreted causally, so it is easy to associate the function itself with its interpretation. Sometimes knowing the cause of a phenomenon increases our ability to predict it, so it is understandable that causation might be identified with prediction. The identification of causation with logical implication rests on a conflation of underlying reality and statements or propositions about it. What follows is an attempt to distinguish genetic connection from the ideas of functional dependence, prediction, and logical implication. While philosophers and economists often call these ideas "causation", we wish to highlight the characteristics of genetic causation they do not include.

1. Functional Dependence

Frank Knight [1956: 94-95] thought of causal relations in science as functional dependence. Although the asymmetry inherent in the relation of cause and effect appears to be missing when functions are reversible, it can be found in the larger context of the model, according to Knight. At any given moment some variables are considered endogenous and others exogenous. When the value of an exogenous variable changes, it will be associated with a change in the value of the endogenous variable. The essence of causation-as-mathematical-function is this simple covariation. Unfortunately, Knight's view either begs the question of how to determine, in the real world, whether or not an event should be modelled as a change in an exogenous variable; or it falls into causal instrumentalism, that is, it simply asserts that causation is a property of models alone. Another weakness of the approach is its implication that only external phenomena can be causes. Internal phenomena, such as changes in beliefs that arise out of frustrated attempts to implement plans are, by definition, excluded.[39] But to the extent that we are interested in understanding the origin of actions, changes in belief are causes. Furthermore, Knight's view of causation omits a sense of generation, for there is only covariation either at a point in time or between points in time. Even where it attempts to portray generation by linking together a series of steps or states, it must fail to exhibit a true dynamic process. Dynamic continuity is possible only when the source of motion lies in the previous phase of development, that is, only when causes are internal. Where causes are required to be external, the system can only react successively to a series of unrelated shocks.[40]

2. Predictive Capacity

The identification of causation with predictability can be found in the econometric work of C.W.J. Granger [1969] and Christopher A. Sims [1972]. The conception of causation in the Granger-Sims approach is related to Knight's inasmuch as it embodies the functional dependence of one variable on another. In this case, however, the focus is on the epistemic feature of functions. If the cause or exogenous variable is known, then, via the functional relation, the effect or endogenous variable can be predicted. In Granger's words, "We say that Y_t is causing X_t if we are better able to predict X_t using all available information than if the information apart from Y_t had been used." [1969: 428].[41] Operationally, better prediction means that the variance of the unbiased least-squares forecast error is lower when we add a cause to the functional relationship.[42] In the "instantaneous causation" formulation there is no asymmetry in the relationship between cause and effect. This is because if

[39] Changes in belief are quasi-spontaneous in character. They are induced by phenomena within the system, that is, by frustrated attempts to implement plans. But they are spontaneous in that how they change is not strictly determined by any factor within the system. See Section VII-4 below.

[40] One attempt to remedy the difficulty in part, can be found in the idea, derived from Herbert Simon, of "exogeneity in a subsystem". Here a variable may be endogenous relative to some equations in the system, and exogenous relative to others. This is the case, for example, in a recursive system. See Hausman [1983:63-6]. In the context of the system as a whole, a cause can be endogenous, but it still must be exogenous in the context of the part of the system under analysis. In a later article, Hausman [1990] adapts this idea to the understanding of Marshallian partial equilibrium. Factors that are endogenous in a general equilibrium model (and hence not causes on Knight's view) may be exogenous and unidirectional in influence and hence Knightian causes in a partial equilibrium analysis. The latter, usually impounded in the *ceteris paribus* clause, are factors like income, and the prices of substitutes and complements.

[41] It is not clear whether this is a definition of causation or simply a test for its presence. Most economists refer to the "Granger test" thus implying that there is an underlying phenomenon for the presence of which Granger has given us a test. Nevertheless, there is a persistent confusion in the literature stemming from the positivist identification of the phenomenon with its test. See Granger [1980: 333].

[42] The roots of this view can be found in Herbert Feigel [1953: 408]: "The clarified (purified) concept of causation is defined in terms of *predictability according to a law...*" Note, however, that the italicized phrase is crucial in distinguishing between a causal connection and a mere coincidental succession. Zellner [1979: 13] criticizes Granger for not mentioning the role of economic laws or theory and for giving "the impression that purely statistical criteria can be employed in defining causality."

knowledge of Y enables us to "predict" X, the reverse is true as well.[43] Thus if Y is causing X, X is also causing Y. Because of this feature, Granger [1988: 204-8] finds instantaneous causation unsatisfactory in principle (as he did originally), although cases of *apparent* instantaneous causation may occur. To establish an asymmetry Granger introduces a temporal lag: "The cause occurs before the effect." [1988: 200]. Although this is the main asymmetry in the system it is purely temporal, and not causal.[44] A causal asymmetry requires a unidirectional genetic process or connection. The feature of predictive capacity does not necessarily involve such a process. It can be based on a simple "black box" or covariational relationship.

The Granger-Sims definition is both too wide and too narrow. Not every event that raises the probability of some other event is a cause; nor does every cause appear to raise the probability of its effect. A fall in the barometer, although associated with an increased probability of a storm, is not the cause of a storm. There is something more fundamental, that is, a fall in air pressure, that is the common cause of both events. On the other hand, some event may be a cause and still not raise the probability of its effect. To see this, consider an example of Hesslow [1976]. Some researchers believe that the use of oral contraceptives sometimes causes thrombosis. It may also be the case that pregnancy causes thrombosis with greater frequency. Suppose both statements are true and that oral contraceptives are largely effective in preventing pregnancy. Then the data would show that among women of childbearing age the use of oral contraceptives *reduces* the probability of thrombosis, despite the fact that it is a cause of thrombosis.[45]

3. Logical Implication

A final common view of causation can be traced to Bertrand Russell who in 1914 assimilated causation into logical implication. He defined a causal law as "any general

[43] Prob $(X_t | Y)$ > Prob (X) implies that Prob $(Y_t | X)$ > Prob (Y).

[44] This leads Granger and Newbold [1977: 225] to question use of the term "cause" for their idea: "A better term might be *temporally related*, but since cause is such a simple term we shall continue to use it." Earlier Sims [1972: 543] admitted that the "method of identifying causal direction employed here does rest on a sophisticated version of the *post hoc ergo propter hoc* principle." For the conventional view that *post hoc ergo propter hoc* is a logical fallacy rather than a principle, see Joseph [1916: 596].

[45] It is true that in both of these cases "adjustment" of the test could show results consistent with the Granger criterion. If we were to hold air pressure constant while allowing the barometer to fall, a falling barometer would *not* raise the probability of the storm. If we partitioned the class of women of child-bearing age into those who, despite taking contraceptives, became pregnant, and those who did not, we would observe a greater probability of thrombosis in the former subclass. These adjustments would be "obvious", though, only if we understood, *ab initio*, something about the underlying causal relationships. In either case, the partition is something we are led to construct by our prior understanding of the causal relationships between storms and air pressure, or oral contraceptives and thrombosis. See Cartwright [1983: 37-8] for a discussion of a similar point. In general we should point out that at one time Wesley Salmon believed that such adjustments were adequate to support a positive statistical relevance theory of causation (a theory similar to Granger's). Salmon now believes this theory to be defective and that the description of processes is integral to causal explanation [1984: 44-5; 139-57; 192-205]. See Garrison [1984: 595-96] for a further analysis of the Granger test. See also Hoover [1990:213].

proposition in virtue of which it is possible to infer the existence of one thing or event from the existence of another or a number of others" [1952: 216]. So, in economics, the data and functional relations from which we can deduce the "existence" of equilibrium can also be said to be the causes of that equilibrium. There is a confusion here between conditions that determine the nature of an equilibrium, ***should it come about***, and those events that actually bring such an equilibrium into real existence. Such a confusion seems to be present in Sir John Hicks's idea of "contemporaneous causation" [1979: 24-5] in which the contemporaneous factors from which we can *deduce* steady states are considered causes. Furthermore, if a set of conditions is both necessary and sufficient for a certain outcome (as is the case here), then that outcome is both necessary and sufficient for the set of conditions. This means that the asymmetry characteristic of causal connection cannot obtain when the postulated relationship is one of logical implication.[46]

VII. EXAMPLES OF GENETIC CAUSATION

In this final part we shall examine several economic models that embody many, if not all, of the characteristics of genetic-causal thought. In the first section we confront causal with non-causal systems of analysis, making reference to some "classical" disputes in economic theory. The remaining examples all focus on knowledge but do so in different and increasingly radical ways. Thus in the second section the deliberate search for the correct price to charge is a central feature of market activity which "invalidates" the law of one price. In the next case, the recent technology-choice literature is examined as a case in which the order of individual choices changes the ultimate equilibrium at which the system settles. In the fourth case, arbitrage or trading at false prices is pushed to the centre of adjustment processes. The informationally-rich content of market prices is traced causally to this disequilibrium trading. In the fifth example, the role of ignorance in advancing the equilibrating process is explored. In the sixth case, an apparent exception to causation and causal explanation known as "hysteresis" is examined. In the final example, the reader's attention is drawn to the possibility of separating causal from equilibrating processes.

1. Causation versus a Poistem

(i) A causal story explains how an outcome is generated. A poistem, on the other hand, depicts the various interrelations that constitute an outcome. A poistem is simply "a system of

[46] Hicks [1979: 24] admits that asymmetry need play no role in contemporaneous causes for they may have a "reciprocal" or "mutual" relationship with their effects. See Bunge [1979: 226-247] for additional problems connected with the logical implication view of causation.

interrelated qualities or variables" [Bunge, 1960: 401].[47] In this section we illustrate the difference between these different levels of theory by reference to two disputes in the history of economics. The first is a comparison of alternative ways of incorporating marginal utility into monetary theory. Ludwig von Mises followed the genetic-causal approach, while Don Patinkin incorporated utility by way of a poistem. Both were concerned with answering the following "circularity charge": The purchasing power of money cannot depend on the demand for nominal balances, because the demand for nominal balances depends on the marginal utility of money, and marginal utility itself depends on the purchasing power of money. Mises escaped from this circularity by his "regression theorem." *Today's* marginal utility of money depends upon *yesterday's* purchasing power, and so on with all previous periods. "The theory of the value of money as such can trace back the objective exchange-value of money only to that point where it ceases to be the value of money and becomes merely the value of a commodity" [Mises, 1971: 120]. Since at some point in the historical regression money came into being from a commodity that was demanded for non-monetary purposes, the circularity problem is avoided even for the first monetary period. At first glance, this appears to be a backward-looking causal process wherein a previous objective event generates a current or future event. Indeed, Mises was insufficiently aware of the genetic-causal element implicit in his theory. We must understand that the causal factor is a mental event and, in the explanation of human action, it must refer to the *expectation* of circumstances or consequences. Thus embedded in Mises' argument is a simple theory of adaptive expectations formation. The expected purchasing power of money, which is the actual variable of interest here, is hypothesized to be "derived" from the actual purchasing power in the previous periods. This incorporation of the past is not deterministic, however, for the implied weighting of each previous period's purchasing power is neither constant nor exactly predictable.[48] Hence individuals who must decide the amount of cash balances to hold are not required to know in advance the outcome of a market process that generates the purchasing power of money. They look to the future in a way that loosely incorporates the past and thus their demands, based on expectations, *cause* the current value of money.

Patinkin saw no need for the regression theorem. He said that his argument "frees the marginal-utility theory of money from any logical dependence on it" [1965: 575]. Patinkin's argument [1965: 114-116] is that we must simply make the elementary distinction between a demand function and the actual quantity demanded. A demand-for-cash-balances function

[47] Bunge coins "poistem" from the Greek *poiótes* meaning quality, and *systema* meaning system.

[48] See Mises [157:314] for his general philosophy of scientific explanation consistent with this view. See generally Salerno [1995] for an excellent discussion of Mises's ideas on expectations.

requires that we associate quantities demanded with different *hypothetical* price levels. And then the intersection of this curve with a vertical supply curve of money determines the actual price level. The word "determines" is, however, highly ambiguous. As used here, it means mathematical derivation and not causal generation. There is one point at which the price level, the quantity-demanded of nominal cash balances, and the stock of money are all consistent with each other. Patinkin's analysis simply derives that point.[49] This is the basic idea of a poistem. Lacking any fundamental asymmetries between the elements of the model (the demand curve and the supply curve) the determination cannot be causal.[50] Since it cannot be causal, we have no assurance that the price level will *actually* settle at the point determined by the analysis. Thus the answer provided by a poistem may simply be incorrect.

(ii) J.M. Keynes [1987: 115] launched a similar circularity charge at the classical theory of interest. (This theory is similar in spirit to Patinkin's rescue of the marginal utility theory of money.) The classical economists believed that the interest rate is determined by the supply of and demand for savings. Under stationary conditions agents correctly anticipate the equilibrium rate of interest and so the supply of credit is equal to the demand for it. Since the *ex ante* quantity supplied is equal to the *ex ante* quantity demanded, the equilibrium rate obtains.

Keynes argued that an attempt to employ this argument outside of equilibrium would fall to circularity. What allows the correct prediction of interest rates is that we are now, and for some time have been, in equilibrium. If we have not been in a stationary state, the interest-rate predictions of many agents will be incorrect. It follows that the quantity of credit individuals plan to offer in supply will in general not be equal to the quantity others plan to demand, and so the equilibrium rate will not obtain. To achieve the equilibrium rate, agents need to be able to predict correctly that next period's rate will be equal to it. But to predict correctly, they need the stability of a stationary (equilibrium) state. It should be obvious that this type of reasoning cannot produce a process that will generate equilibrium.[51] The Marshallian analysis is a poistem.

For Keynes, the interest rate was caused by the beliefs of actors in the money market. The interest rate would settle on whatever magnitude was expected to endure by those on the margin between money and bonds. At rates above or below that, wealth would shift in an attempt to capture capital gains or avoid capital losses. Thus the interest rate is caused by the

[49] For an analysis similar to ours see Vaughn [1976: 102-103].

[50] While it is true that in a partial equilibrium setting comparative static manipulation of supply and demand curves can illustrate causal relationships [Hausman, 1990], Patinkin does not use the curves that way. He simply derives the point at which system-wide consistency prevails.

[51] To assume perfect foresight or rational expectations would simply beg the causal question.

beliefs of individuals. These beliefs do not reflect an underlying reality (or "fundamentals") but they are nonetheless highly conventional and stable. This stability ensures that the process causing the (long-term) interest rate is quite predictable. But predictability is not the same as determinacy; Keynes did not deny the autonomy of the human mind: these beliefs *could* change precisely because they are rooted in nothing but convention itself [Skidelsky, 1992: 563].

2. Search-Driven Processes

Michael Rothschild [1974] developed a model in which a firm's price-adjustment process is led by changes in its beliefs about the underlying stable demand curve. The firm deliberately searches for the correct price to charge (that is, the price it would charge if the demand curve were known perfectly), using an experimental technique. It charges a price and then sees how the market reacts. Based on that reaction it decides whether to continue charging that price or to experiment with another price. Thus the series of decisions takes on the characteristics of a process. There is purposive behaviour, and a genetic element exists in the intertemporal link: the next price change depends on the firm's experience with past and current prices. The optimal strategy is to balance the costs of continued experimentation, in the form of changing the current, possibly very good, price, with the expected benefits, in the form of more information about demand parameters. But as the firm experiments, its beliefs about the underlying demand curve change, becoming stronger and stronger. It changes its price in accordance with these changing beliefs. In equilibrium each firm will charge a price that depends on its own experimental history, so firms will not necessarily charge the same price. Hence not all will charge the "correct" price, even after all adjustments have been completed. So the history of changes in beliefs—that is, the causal history—will generate the equilibrium price distribution. Jevons's law of the single price, a primary characteristic of a frictionless noncausal model, is rendered inapplicable.

3. Choice of Technology

The recent literature on the choice of technology and technological standardization can be seen as concerned with choices that rupture the link between primitives (the objective characteristics of a technology) and the ultimate equilibrium.[52] Agents act independently, but their actions jointly "select" an equilibrium as later adopters react to the actions of earlier adopters, pushing the market shares of the different technologies toward a stable

[52] See Arthur [1988] or David and Greenstein [1990] for recent surveys.

configuration, one that might not have been selected had agents known future returns *ex ante.*[53]

Individual agents are faced with a choice among several technologies and choose the ones they believe will maximize their net benefits. The choice of any agent, however, changes the relative values of different technologies, and so affects the choices of future adopters. One factor that has been stressed in this regard is increasing returns to adoption: learning by using, learning by doing, and network externalities. These are all features of technologies that act to increase the net benefits of adopting a technology as it is more frequently adopted. A second factor that has been stressed is that as a technology is used, experiences with it change agents' beliefs about how "good" it is. When either of these factors is present small events can have a large impact on the evolution of the system. A small event—an early choice caused by the idiosyncratic tastes and beliefs of an early adopter, for example—can start a bandwagon, pushing the market toward one technology or standard as opposed to some other.[54]

Dynamic models of technology choice exhibit path dependence in that the selection of the final equilibrium depends on events along the path towards it. Even in models in which choices are co-ordinated by some central body, path-dependent effects arise through the accumulation of information about the relative merits of the competing technologies. Beliefs form and change as technologies are used, but eventually the (possibly erroneous) belief that one technology is better than all the others will harden, and drive future adopters to choose that technology.[55]

From a genetic-causal perspective this approach to the study of technology embodies at least three important characteristics. First, the beliefs of agents exercise an independent influence on the ultimate market choice of technology. Erroneous beliefs, early in the process, can be more important then the underlying technological characteristics. Second, the models emphasize the backward-looking constraining aspects of choice: past decisions affect future returns. In many models, however, this is an implicitly forward-looking element in the framework. It is not really past adoption, but expected *continued future use* by others, or actions taken to improve the future knowledge of the agent, that are responsible for the increased expected returns. Third, the approach can be contrasted to both evolutionary economics and the arbitrage-equilibration process discussed below. The difference lies in the way equilibrium is treated. The choice of technology literature treats equilibrium in a neo-classical way, namely

[53] This description covers most, but not all, of the work in the field. While concentrating on similar forces and issues, Farrell and Saloner [1985] investigate agents who move simultaneously. In some models eg. Kirman [1992] the stability is in the distribution of market shares over time rather than in the market shares themselves.

[54] See Cowan [1990] for a detailed study of this effect in the market for nuclear power reactors.

[55] See Cowan [1991].

as a point at which the system will rest, but also focuses attention on the path by which the system gets to equilibrium. Evolutionary and arbitrage economics, while still interested in the path, lay less stress on the "place of rest" aspect of equilibrium, and treat it more as a centre of gravity towards which the system moves. Perhaps this is because in the evolutionary and arbitrage approaches the disturbing changes occur more rapidly relative to the adjustments than is the case in the technology choice literature. On this view the equilibrium itself can be constantly in motion, changing position with changes in agents' beliefs and actions.

4. Arbitrage and Discovery-Driven Processes

In the Walrasian tradition, trading at "false prices" is a troublesome phenomenon that deflects both the economy and the analyst from the basic underlying reality: the equilibrium position. In the genetic-causal approach, however, false trading by at least some agents is the *sine qua non* of economic processes and constitutes a major focal point of research, rather than a deflection from that research. Recent arbitrage theories of economic dynamics are excellent examples of this latter approach. Changes in belief, whether characterized as alertness to hitherto unnoticed profit (arbitrage) opportunities [Kirzner, 1973], or disequilibrium awareness of new opportunities [Fisher, 1983], drive the system. Suppose, as the simplest example, the prices of apples in two different locations in the same market are fifty cents and seventy-five cents respectively. The buying low and selling high of the arbitrageur *tends* to equilibrate the market. The focus of at least Kirzner's variant of this literature is an equilibrium as a centre of gravity and not as an actual rest point. This is because the underlying data of the system are viewed as continually undergoing change [Thomsen, 1992:22].

Within a determinate noncausal system, however, it is difficult to see false prices or price differentials as true profit opportunities, If knowledge is always optimal then there really are no opportunities net of the costs of searching for them. At the level of market analysis, this implies that all existing situations are equilibrium and, most importantly, that no motion can emanate from within the system. Only exogenous changes in knowledge can generate motion (when desires are constant). If, however, individual decisions—including decisions leading to the acquisition of knowledge—are not tied rigidly to previous objective conditions or the previous state of knowledge, then there can be internally-generated change. When (entrepreneurial) discovery is not necessitated by previous knowledge and when previous knowledge does not bear a necessary relationship to discovery,[56] then it cannot be construed as "optimal". True profit opportunities exist because individuals could have previously discovered

[56] In Kirzner's formulation discovery cannot be deduced from a given framework nor is any factor of production needed to generate discovery [Kirzner, 1979b; 1979a: 130]. Thus the previous state of knowledge is neither necessary nor sufficient for entrepreneurial discovery. See characteristic 1(iii) of genetic causation.

more but did not do so. The prior state of knowledge *under–determines* the individual's discovery. Hence discovery can be characterized as quasi-spontaneous. This is an internally-generated change because the previous incomplete state of knowledge (an internal state) generates arbitrage opportunities. These opportunities provide the incentives for additional learning which, these theories hold, is incompletely determined by the prior state of knowledge. Nevertheless, the prior state renders some of the new knowledge intelligible *ex post*.[57]

5. Ignorance and Equilibration

The most reasonable inference to draw from a poistem perspective is that ignorance of profit opportunities is an obstacle to equilibrium. If agents do not have perfect knowledge of the returns available throughout the economy, resources will not be allocated to their most highly-valued uses. Thus, the equilibrium implicit in the underlying data will not be achieved. But if there could be a reduction in ignorance, the system would ultimately find itself closer to that equilibrium.

When we focus not on the state of equilibrium, but on the process of equilibration, ignorance appears less like an obstacle. True, if ignorance were perfect—if no one knew about relative investment returns—neither equilibration nor an approximation to it could be achieved. On the other hand, though, if everyone had complete knowledge of profit opportunities and was equally able to respond to them, the potential for an over-response to the initial disequilibrium could negate the profit opportunity [Richardson, 1990]. Consider that in a long-run disequilibrium an indefinitely large number of new entrants would try to take advantage of supernormal profits in any particular industry. Even if the output response of any given entrant is limited the aggregate output response would be indefinitely large. Thus, a "general profit opportunity, which is both known to everyone, and equally capable of being exploited by everyone, is, in an important sense, a profit opportunity for no one in particular." [Ibid.: 57] If some individuals were less able to discern profit opportunities than others, that is, if there were some, but not complete, ignorance of opportunities, the potential for avoidance of over-response and thus for equilibrium would seem to be greater. The *universal* awareness of profit opportunities is inconsistent with a causal process of equilibration (although it may be one of the defining characteristics of an equilibrium state). Only something short of universal knowledge—asymmetric knowledge—can generate an

[57] Brian Loasby [1991] views the relationship between the prior state of knowledge and new knowledge as a relationship between a research program and discoveries within it.

equilibrating process. A causal perspective reveals that a certain amount of ignorance is an aid, rather than an obstacle, to achieving equilibrium.

The necessity of error in processes of putative equilibration means that the equilibrium toward which the system moves cannot be deterministic, that is, *cannot* be implied in the antecedent data. To the extent that agents engaged in substitute or complementary activities commit errors these will change the appropriate (that is, equilibrating) activity of each related agent [Kirzner, 1992: 31-4]. Thus the relevant equilibrium is constantly changing and is "defined in the process of its emergence" [Buchanan, 1986: 73].[58]

6. Hysteresis: Limit to Causal Explanation?

It is sometimes claimed that hysteretic phenomena constitute an exception to causation, or less radically, a limit to causal explanations. While there are different definitions of hysteresis, a useful, if somewhat imprecise, one is: "hysteresis effects...are those that persist after the initial causes giving rise to the effects are removed." [Cross, 1993:53]. If this definition is taken literally, hysteresis is not an exception to the causal principle but a different kind of causation: causation at a distance. Since the ontological possibility of causation at a distance is not generally accepted [Leibniz in Elster, 1976: 372], the definition cannot be take literally and hysteresis "effects" are not effects at all but uncaused events (i.e., events functionally determined by state variables). Thus many economists who believe in the importance of hysteresis make a distinction between ontological and epistemological hysteresis [Cross, 1993: 54-6; also Elster, 1976: 372-75]. The first is considered impossible because it violates strictures against action at a distance, while the second is considered expedient in explaining certain economic events. Why might an economic event be caused by a temporally adjacent factor(s) yet not be explicable in those terms?

To answer this question, consider that it is possible to look at path dependency as a form of hysteresis [Cross, 1993:68-71]. This is because "intermediate events" can be seen as affecting the later equilibrium. The particular history of a system outside of equilibrium will generate one of many possible equilibria. Because this history consists of events separated in time and space from the equilibrium, the "process" is considered hysteretic. Yet it appears so only because we are concentrating on external events (e.g. prices and quantities) rather than on the internal events of experience, memory and expectation. As we have emphasized, the experience of a disequilibrium path will, through memory, affect current expectation and hence the new equilibrium. Thus there really is an unbroken causal chain linking the phases of an

[58] Unless errors are of a systematic kind, the economist will not be able to infer a path, and hence a new equilibrium from the initial data.

economic process.[59] Most economists recognize this. The problem emerges when internal causal factors are not easily observable [Elster, 1976:372]. Thus, it will be claimed, the practical exigencies of explanation may require attention to measurable, external events. This is true only if the concept of explanation must exclude non-observable events in the *explanans.* Economics, however, has always included non-observables in its canonical form of explanation: utility, for example, is a not-directly-observable mental experience.[60]

Consider an example of hysteresis that should make these points clear. Several authors have recently argued that the natural rate of unemployment is a function of past actual rates. Specifically, Lindbeck and Snower [1988] have claimed that unions react to unemployment in such a way as to affect the long-run "permanent" (natural) rate. Imagine a stochastic steady state in which shocks arise periodically, at first reducing the size of the workforce in particular industries. With a smaller workforce and the same shocks, the employment security of the remaining workers is improved when the demand for labour later increases. Since rehiring the dismissed workers (especially after considerable lapse of time) involves significant transactions costs, the remaining workers press for higher wages through the unions. These higher wages make the new smaller workforce "permanent". Thus the history of unemployment rates determines the natural rate. Notice, however, the difference between the functional relationship to which the above story gives rise and the story itself. The functional relationship emphasizes the importance of previous external events (the unemployment statistical series), while the story emphasizes the changes in desires and beliefs of the unionized workers arising out of their experiences. Clearly the functional relationship would not command any degree of assent were it not supported by a plausible story of workers' intentions and purposes. References to such intentions and purposes is a legitimate part of economics. Hence hysteretic *appearances* need not prevent the search for causal relationships.

7. Does Causation Imply Equilibration?

Probably most economists who have written in the genetic-causal tradition viewed processes as equilibrating. Indeed Fossati saw such a strong connection that he called genetic causation a "development of the concept of equilibrium" [1965: 43]. Nevertheless, any such connection between the two ideas is not essential. It is no part of the meaning of genetic causation that causal processes must move the system toward equilibrium, even an emergent equilibrium.

[59] Note the relationship between this point and our claim that causal explanation is based on scientific and common-sense realism. See section V-1i.

[60] Gary Becker [1976:7] also advocates reference to unobservable or hard-to-observe costs in framing explanations in order to preserve the assumptions of constant and identical tastes.

Joseph Schumpeter's theory of induced innovation [1961] is an example of a non-equilibrating causal process. The allure of profit leads to or induces the development of innovations, that is, the novel application of existing scientific information to production techniques. Schumpeterian innovations are changes in beliefs about production possibilities that arise from within the system. They are explained internally by the pursuit of profit rather than as shocks coming from the outside. Schumpeter believed that the static method, with its emphasis on equilibrium, is adequate to handle the adjustment of the system to an external change in the data; it is not adequate to handle internal changes in the data [Ibid.: 62]. This is because genuine innovations generate change that is not simply *adjustment* to data.

The most important reason that causal processes may not be equilibrating is to be found not in the propensity of economies to change the technical data endogenously, but in the propensity of individuals to err in forecasting the actions of others. Although there are many contributors to the literature discussing this point, the basic idea was most forcefully expressed by G.L.S. Shackle [1972]. Outside of equilibrium, the actions of different individuals are not reconciled. The optimal plan for one individual depends, in large part, on what others are planning to do. To the extent that choices of individuals are originative, that is, not mechanistically tied to what has gone before, there will clearly be errors in forecasting the actions of others. These errors will make it difficult, if not sometimes impossible, to achieve or move towards equilibrium in the sense of a general compatibility of plans. The changes in beliefs generated by disequilibrium need not map out a causal process tending to restore equilibrium. Thus attention to causation reveals that the equilibrium results implied by a Patinkin-style analysis may be fundamentally incorrect.[61]

[61] While Shackle's discussion of the nature of causal processes may seem one-sided, Leijonhufvud [1981: 109-110; 337-339] provides a paradigm that integrates both the non-equilibrating and equilibrating views of causal market processes. Inside the "corridor", that is, when the economy is near equilibrium, the buffers maintained by transactors are sufficient to prevent unexpected actions of others from upsetting their optimal plans. Input and output inventories, spare capacity, liquid assets and credit lines all enable individuals to continue implementing their original plans. This is because the "unexpected" actions of others are all really within the *range* of expected actions. When the economy is outside the corridor, on the other hand, it is far from equilibrium. The actions of others may be, under these circumstances, genuinely outside the expected range and thus the buffers in the system may be inadequate to ensure equilibration. In these circumstances it is possible that causal processes will reinforce the displacement from equilibrium, rather than correct it. The changes in beliefs generated by a disequilibrium can, *at least for a time*, exaggerate in an explosive fashion, the initial errors that gave rise to that disequilibrium.

Another way in which the non-equilibration of causal processes can be observed in economic models is exemplified by Peter Howitt's [1990] model of Wicksell's cumulative process in which agents update the inflation expectations in light of recent experiences. He shows that because of the way agents update these expectations, the process will not converge to a rational expectations equilibrium in the face of a monetary policy based on tight interest control.

VIII. SUMMARY

The genetic-causal tradition stresses the importance of unidirectional economic processes propelled by the desires and beliefs of individuals. It embodies a common-sense realism, insofar as it affirms the reality of desires and beliefs, as well as a scientific realism to the extent that actions based on these desires and beliefs are the causes of unintended market outcomes. Genetic or originating causes are the endogenous source of economic changes. Explanation in terms of these causes seeks to provide understanding of what generates or brings into existence a state of affairs, not simply what sustains that state.

In contrast, much, though clearly not all, of modern economics can be characterized as a search for models and levels of analysis within which observed phenomena are equilibrium phenomena. While desires and beliefs do enter these models, they are, as Friedman argued they should be, largely instrumental—a means of grounding the models, without realistic content. In addition, if at the "right" level of analysis the world is in equilibrium, then at that same level of analysis there is no change and thus no genetic causation. This approach, while clearly useful in some ways, cannot answer the fundamental question of why the world is in, or even near, equilibrium.

The instrumental value of genetic-causal explanation is that it explains, *inter alia,* why an equality of supply and demand might ever exist, and why prices embody accurate information about the economic goods traded. Essentially, genetic-causal explanation attempts to illuminate the processes of economic life that lead to these results.

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