

**Capital in Disequilibrium:**  
**A reexamination of the capital theory of Ludwig M. Lachmann.**

**Peter Lewin**

*History of Political Economy*, Winter 1997, forthcoming.

**Capital in Disequilibrium:  
A reexamination of the capital theory of Ludwig M. Lachmann.**

**Peter Lewin<sup>1</sup>**

*Introduction: Ludwig Lachmann and the Austrian Theory of Capital*

[T]he long retreat from Böhm Bawerk's classical objectivism in the theory of capital, which started with Professor Hayek's reply to Knight in 1936, was continued in his *Pure Theory of Capital* of 1941 and to which I endeavored to give provisional expression in my book *Capital and its Structure* in 1956, [here] reaches a new stage. (Lachmann 1986, x).

The last quarter of the twentieth century has seen something of a revival of Austrian economics, or, what is increasingly becoming known as market process economics. Works on entrepreneurship, monetary theory, free banking, monopoly, methodology, institutions, etc. have proliferated. It is somewhat ironic that in the world of mainstream neoclassical and Keynesian economics, as well as among economists in other dissident schools, Austrian economics is probably best known for its association with the theory of capital, yet this modern revival has produced relatively little work on capital.

The most famous Austrian capital theorist, Eugene von Böhm Bawerk, produced a three volume (multiple edition) tome on *Capital and Interest* (Böhm-Bawerk 1881). This work generated considerable controversy among many eminent economists, both during and after Böhm-Bawerk's lifetime. Frederick von Hayek considered the issues raised in capital theory important enough to attempt to continue, and, hopefully, complete Böhm Bawerk's project. Hayek, in addition to numerous articles (Hayek 1939), published *The Pure Theory of Capital* in 1941 (Hayek 1941) which was a rigorous and intricate extended exercise in aspects of intertemporal production, primarily under equilibrium conditions. It was intended to be the first of a two volume work, the second of which was to be an examination of capital issues in a dynamic *disequilibrium* world. Volume two was never produced (as Hayek moved onto other projects). However, in 1956, Ludwig Lachmann, who was a student and colleague of Hayek's at the London School of Economics, published *Capital and its Structure* (Lachmann 1956)<sup>2</sup>. In the preface he stated:

---

<sup>1</sup>I have benefited from the comments of anonymous referees. Correspondence may be addressed to Professor Peter Lewin, Department of Economics, University of Dallas, 1845 Northgate Drive, Irving, Texas 75062

<sup>2</sup>The quotation at the beginning of this section suggests that Lachmann saw himself in some way continuing the work Hayek had begun in his *Pure Theory of Capital*. When asked about the *Pure Theory* Hayek once remarked, "I think the most useful conclusions drawn from what I did are really in Lachmann's book on capital." Kresge and Wenar 1994, 142.

The chief object of this book is thus to rekindle interest in the fundamental problems of capital .... to outline a new approach and to show that it can be applied ... to a number of problems ....I am painfully aware of the fact that this book leaves many questions unanswered. It could hardly be otherwise. But it is my hope that others will follow and make their contributions to the theory of capital. There can be few fields of economic inquiry today which promise a richer harvest than the systematic study of the modes of use of our material resources. (xvi).

In his preface to the unrevised second edition, published in 1976 he noted, "[t]he theory of capital, alas, has made little progress since 1941"(vii). In fact, probably the only notable work on Austrian capital theory in the interim was Kirzner's *An Essay on Capital* (Kirzner 1966).

Lachmann moved from London to the University of the Witwatersrand in Johannesburg, South Africa after the war, where he stayed for the rest of his life (though for some years after retiring he held a visiting appointment at New York University for one semester every year). By the time he moved to Johannesburg, capital theory was already going out of fashion in the wake of the Keynesian ascendancy. *Capital and its Structure* was really the culmination of his earlier work on capital, the most complete of which was his 1947 article (see Lachmann 1938, 1939, 1941, 1944, 1947, 1948). And although *Capital and its Structure* was reprinted in 1976, Lachmann did not further develop his theory of capital<sup>3</sup>. His work in this area pointed beyond itself to his later work on expectations and knowledge and the meaning and importance of subjectivism for which he is so justly noted (see Lewin 1994)<sup>4</sup>. However, given his abiding interest in the theory of capital (to which he returned many times in review articles and discussion papers - see Grinder 1977) and his claim to have "outline[d] a new approach", the lack of attention to this work is unfortunate. This article attempts to remedy this to some extent, by reexamining Lachmann's capital theory. Apart from being valuable in its own right, it is probably true that his work on capital is the only extensive application of his methodology - though there are hints of the implications for monetary theory and policy and labor economics and some other areas (see Lewin 1994).

The rest of this paper is divided into two main sections. The next section outlines Lachmann's conceptual framework, explaining the concepts he uses and the way in which they fit together. The subsequent section explores the relevance of this framework for some issues of contemporary interest. Of particular interest is Lachmann's recasting of Böhm Bawerk's theory of roundabout production in terms of the increasing complexity of

---

<sup>3</sup>In his 1986 work Lachmann (1986) extended his insights on complementarity and substitutability to the nature of knowledge. We take note of this below when discussing human capital.

<sup>4</sup>A collection of essays published in his honor on the occasion of his eightieth birthday contained only one contribution that included a discussion of capital theory, namely "Economic Policy and the Capital Structure" by Peter Lewin. The remaining 22 contributions dealt with philosophical (particularly epistemological) and methodological issues, reflecting Lachmann's reputation as a radical subjectivist. See Kirzner 1986.

the productive process. This approach resonates strongly with recent work in complexity theory<sup>5</sup>.

### *Conceptual framework*

The generic concept of capital without which economists cannot do their work has no measurable counterpart among material objects; it reflects the entrepreneurial appraisal of such objects. Beer barrels and blast furnaces, harbour installations and hotel room furniture are capital not by virtue of their physical properties but by virtue of their economic functions. Something is capital because the market, the consensus of entrepreneurial minds, regards it as capable of yielding an income....[But] the stock of capital used by society does not present a picture of chaos. It's arrangement is not arbitrary. There is some order to it. (Lachmann 1956, xv).

### *Heterogeneity of capital matters in disequilibrium*

A distinction must be drawn between the terms *capital goods* and *capital*. The former refer to physical items (constructed or inherited from nature) that are capable, in combination with labor and other capital goods, of producing valuable consumer goods. Capital, by contrast, has no physical measure. It refers to the total *value* of all of the capital goods under consideration. The values of the individual capital goods are derived by discounting the value of their expected future production. Referring as this does to expected future values, the result is subjective and varies across individuals. The value of the capital stock, being dependent on individual expectations and evaluations (time preferences included) is not an objectively observable phenomenon or necessarily even a meaningful concept. Only in equilibrium, where all individuals' expectations were consistent one with the other, would such a value have any meaning. Lachmann chooses to develop his analysis in a *disequilibrium* framework. This is the core of his claim to be providing a "new approach". In other words Lachmann considered the notion of a capital stock (which made sense in an equilibrium context) to be untenable and unhelpful in a

---

<sup>5</sup>As a professor in Johannesburg, Lachmann lectured on a variety of topics. He was, in fact, responsible for teaching all of the "core" courses for second and third year economics. These courses included monetary economics, Keynesian economics, international economics, economic growth and, of course, capital theory. That there was a course in capital theory at all must be assumed a result of Lachmann's own special interest in the subject. It was surely not the standard fare of undergraduate economics at that time. As might be expected then, this course was heavily influenced by his own work. He attempted, however, to place his work in a wider perspective within the history of capital theory. In what follows I have availed myself of a recently rediscovered set of notes that I took as an undergraduate student in Lachmann's course on capital theory in 1968.

disequilibrium world. He thus offers a theory of the *capital structure* rather than the *capital stock*<sup>6</sup>.

Much has been written, by Lachmann and others, on this question of equilibrium versus disequilibrium analysis. The issue addressed has often been the stability of the market system, which Lachmann, by insisting on disequilibrium, appeared to be denying. In his capital theory this is decidedly not a central issue, however. Rather, one gets the distinct impression, when reading *Capital* and his earlier articles, that a tendency toward equilibrium is being asserted (for example, Lachmann 1956, 40). He was thoroughly convinced, however, that aggregating across different types of capital goods to arrive at an objective measure of the capital stock, (which is, in essence, what the assumption of equilibrium allows us to do) was not only logically impossible, but attempting to do it was also unproductive in the sense that it led to the wrong policy conclusions. His uncompromising critique of Keynes' investment theory can be understood in this light (Lachmann 1956, 7-10 and 70).

Lachmann thus emphasizes the *heterogeneity* of the capital stock. The fact that capital goods are physically very dissimilar is significant precisely because of the existence of disequilibrium. Physical heterogeneity could be reduced to value homogeneity if the values of the various capital goods could be simply added together. Where disequilibrium means that individuals have different and *frequently inconsistent* expectations, one cannot simply add together individual valuations. Even so, the physical heterogeneity is not the essence of the matter. Different physical goods that perform the same economic function could be counted as the same good. It is the difference in *economic function* that matters. For the most part different capital goods look different because they are designed to perform different functions. Heterogeneity in use is the key.

*Capital combinations are understandable in terms of complementarity and substitutability*

The heterogeneity of the capital stock is something that is obvious to anyone. The assumption of homogeneity, made for mathematical and analytical convenience, is never meant as a literal description of reality. It is made in the belief that that is the only way to sensibly incorporate capital into an analytical model, that to do otherwise would reduce one's theorizing to providing an unhelpful description of complex reality. Lachmann, in effect, denies that this is the case. Though the capital stock is heterogeneous, it is not an amorphous heap.<sup>7</sup> The various components of the capital stock stand in sensible

---

<sup>6</sup>The meaning and significance of equilibrium concepts continues to command the attention of economists. It is possible, by defining constraints broadly enough and by defining equilibrium as existing when each individual is maximizing utility subject to these broadly construed constraints, to imagine that equilibrium always exists (see Shmanske 1994). It is important to be clear that Lachmann uses the Hayekian definition of equilibrium as referring to the *ex ante* consistency of individual expectations. And it is in this sense that he later wondered about the meaning of any alleged tendency toward equilibrium.

<sup>7</sup>This is an allusion to the words of Shumpeter 1954 quoted by Lachmann in his lectures. In a section entitled "The Structure of Physical Capital", Schumpeter seems to anticipate

relationship to one another because they perform specific functions together. That is to say, they are used in various *capital combinations*. If we understand the logic of capital combinations, we give meaning to the capital stock and, in this way, we are able to design appropriate economic policies or, even more importantly, avoid inappropriate ones (for example, Lachmann 1956, 123).

Understanding capital combinations entails an understanding of the concepts of *complementarity* and *substitutability*. In neoclassical microeconomics, these concepts are developed within a market equilibrium framework. Production goods are substitutes or complements for one another to the degree to which, and in the manner in which, their marginal products are related. The marginal products of complements are positively related while those of substitutes are negatively related. What is envisaged is a situation in which production goods are combined in a technological relationship of known and well understood inputs and outputs. The values of all possible outputs are known with certainty (or with probabilistic certainty) and from this it is possible to calculate the values of the marginal products under all conceivable circumstances. These are treated as objective. Hence, we have the picture of a given budget line (or hyperplane), formable out of the given *equilibrium* prices of the production goods and the quantities used, confronting a given isoquant. Substitution is then simply a matter of moving around the isoquant in two dimensional or multidimensional space. Substitution occurs because of a change in the price of a production good. There is no analysis of any events that occur in disequilibrium i.e. of events that occur between the time that a price change occurs, is perceived, is acted upon and results in the establishment of a new equilibrium. The same sort of analysis is applied to changes in technology, which are analyzed as changes in the positions or shapes of the isoquants.

As a mental picture of a single production plan at a point of time, the isoquant diagrams (or algebras) may be enlightening. They summarize a certain "logic of choice". But they have little to do with Lachmann's conception of what substitution and technical progress mean in reality. His concepts pertain to a world in which perceived prices are

---

much that is relevant to the present work including the place of human capital, to be addressed below. The phrase to which Lachmann refers in his lectures is embodied in a series of comments extremely resonant with Lachmann's own work. Schumpeter's book was completed (or at least interrupted by his untimely death) in 1950 and published in 1954. Lachmann's book on capital was published in 1956, but his 1947 article contains most of the essentials.

The initial stock of goods is neither homogeneous nor an amorphous heap. Its various parts complement each other in a way that we readily understand as soon as we hear of buildings, equipment, raw materials, and consumers' goods. Some of these parts must be available before we can operate others; and various sequences or lags between economic actions impose themselves and further restrict our choices; and they do this in ways that differ greatly according to the composition of the stock we have to work with. We express this by saying that the stock of goods existing at any instant of time is a *structured quantity or a quantity that displays structural relations within itself*, that shape, in part, the subsequent course of the economic process (Schumpeter 1954, 631-632, italics original).

actual (disequilibrium) prices in the sense that they reflect inconsistent expectations and in which changes that occur cause protracted visible adjustments. Capital goods are complements if they contribute together to a given *production plan*. A production plan is defined by the pursuit of a given set of ends to which the production goods are the means. As long as the plan is being successfully fulfilled *all* of the production goods stand in complementary relationship to one another. They are part of the same plan. (It is not inconsistent to say that their perceived marginal products are positively related, in the sense that their joint outputs depend on each others' performance. An increased availability, reduction in price, of any one input, raises the potential outputs of the plan attributable jointly to all of the inputs and may increase the (joint) demand for all of them.) The complementarity relationships within the plan may be quite intricate and may involve different stages of production and distribution. Substitution occurs when a production plan fails (in whole or in part). When some element of the plan fails a contingency adjustment must be sought. Thus some resources must be substituted for others. This is the role, for example, of spare parts or excess inventory. Thus, complementarity and substitutability are properties of different states of the world. The same good can be a complement in one situation and a substitute in another.

Lachmann uses the example of a delivery company (Lachmann 1947, 199 and 1956, 56). The company possesses a number of delivery vans. Each one is a complement to the others in that they cooperate to fulfill an overall production plan. That plan encompasses the routine completion of a number of different delivery routes. As long as the plan is being fulfilled this relationship prevails, but if one of the vans should break down, one or more of the others may be diverted in order to compensate for the unexpected loss of the use of one of the productive resources. To that extent and in that situation they are substitutes. Substitutability can only be gauged to the extent that a certain set of contingency events can be visualized. There may be some events, such as those caused by significant technological changes, that, not having been predicted, render some production plans valueless. The resources associated with them will have to be incorporated into some other production plan or else scrapped - they will have been rendered unemployable. This is a natural and predictable result of economic progress which is driven primarily by the trial and error discovery of new and superior outputs and techniques of production.

What determines the fate of any capital good in the face of change is the extent to which it can be fitted into any other capital combination without loss in value. Capital goods are *regrouped*. Those that lose their value completely are scrapped. That is, capital goods though heterogeneous and diverse are often capable of performing a number of different economic functions. Lachmann calls this property *multiple specificity*.<sup>8</sup>

Lachmann's world is consciously similar to Schumpeter's world (Schumpeter 1912) of "creative destruction", except that for Lachmann the innovating entrepreneur is not disrupting some preexisting general equilibrium. His world is one in which a continuous evolutionary process of changing patterns of capital complementarity is occurring. At any

---

<sup>8</sup>He seems to have invented this term fairly late in the development of his ideas on capital. In his 1947 article he never uses it and instead uses the term "versatile" which he credits to G.L.S. Shackle.

point in time different entrepreneurs will have different and frequently incompatible production plans. Over time the market process will validate some and invalidate others. Lachmann sees the market process as tending to integrate the *capital structure*, in other words, rendering plans more consistent.

*The capital structure is shaped by capital gains and losses*

The concept of the capital structure (to be explained further below) is built out of the notion of capital complementarity. A production plan is a construction of the human mind. As such it exhibits a necessary internal consistency. From the point of view of *the individual planner*, it might be said (although Lachmann did not use this terminology) that the plan is always in equilibrium. The plan is always in equilibrium in the sense that every planner, being rational, may always be counted on to do the best he/she can, given all the relevant constraints, where such constraints include the time available to adjust to any unexpected changes. That is to say, at any given point of time any individual planner is in equilibrium with respect to the world as he/she sees it at that point of time. All productive resources employed in that plan stand in complementary relationships to one another. *Between* any two points of time, during which unexpected changes will necessarily have occurred, resource substitutions will have been made in an attempt to adjust to the changes. Thus, whether we characterize the individual planner as being continuously in equilibrium or else as continuously adjusting to disruptions of his/her production plan, would seem to be more an issue of semantics than of substance. Strictly speaking, if we visualize an individual adjusting to a disruption of equilibrium, then there must have been an instant, however short, during which the individual was out of equilibrium by his/her own assessment. So an "equilibrium always" characterization does not appear to be logically tenable for a world in which unexpected changes occur. The important point, however, is that Lachmann did think that the notion of individual equilibrium was a sensible one and that it could be applied within the context of the individual plan. Complementarity is a condition of plan equilibrium (stability), substitutability is a condition of plan disequilibrium (change).

When it came to general or market equilibrium, Lachmann was much more hesitant. The notion of the capital structure does encompass a sort of economy wide equilibrium as an ideal type. At the individual level disparate elements of the production plan are brought into consistency by the planner. These elements are all present in a single human mind. There is no such mechanism guaranteeing consistency between different production plans. The market process does, however, tend to eliminate inconsistencies between plans in so far as not all of them can succeed. In this way plans that are consistent with (complementarity to) one another tend to prevail over those that are not.<sup>9</sup> So whereas the individual planner ensures the complementarity of all of the resources

---

<sup>9</sup>This would seem to imply that the production plans of individual firms are identical with the plans of one or other individual in that firm. This is not necessarily the case however. Firms must find a way to harmonize the different visions of its various planners. Presumably the larger the firm the more difficult this is. But those firms that do so more successfully and adopt successful supra plans will tend to survive. The market process works its way into the firm in this way.



within a production plan, the market process tends towards a situation of overall *plan complementarity*.<sup>10</sup> This is what constitutes the capital structure. The heterogeneous assortment of capital goods stand at any time in a kind of ordered structure defined by their functions and by the relationships that the various plans have to one another. The latter is a result not of any supra plan, but of the market process. A capital structure in which this tendency were complete, in which every capital good and every production plan was complementary to every other, would be a completely *integrated* capital structure. In summary:

In a homogeneous aggregate each unit is a perfect substitute for every other unit, as drops of water are in a lake. Once we abandon the notion of capital as homogeneous, we should therefore be prepared to find less substitutability and more complementarity. There now emerges at the opposite pole, a conception of capital as a *structure*, in which each capital good has a definite function and in which all such goods are complements. It goes without saying that these two concepts of capital, one as a homogeneous fund, each unit being a perfect substitute for every other unit, the other as a complex structure, in which each unit is a complement to every other unit, are to be regarded as *ideal types*, pure equilibrium concepts neither of which can be found in actual experience. (Lachmann, 1947 199).<sup>11</sup>

Lachmann chose to describe the world in terms of a capital *structure* rather than a capital *stock*. This choice reflects a judgment that to obscure capital complementarity through aggregation would result in an inaccurate and misleading picture of the role of capital in the economy. This can be seen in his account of how the market process works.

At any moment in time individual planners hold inconsistent expectations. This means that the passage of time must disappoint some of them. Some production plans must fail (in part or in whole) while others, of course, may succeed beyond their expectations. This is reflected, according to Lachmann, in two crucial ways - in capital reevaluations (*capital gains and losses*) and in *changes in cash balances*. Whereas the "wealth effects" of neoclassical economics are usually assumed to be small enough to be neglected, the capital gains and losses of Lachmann's world are the most important forces driving changes in the capital structure. These market evaluations of the prospects of success or failure of the firm and its capital combination are reflected in the financial assets associated with the firm. The financial assets (for example, debt and equity) form a superstructure over the capital assets of the company and constitute its *asset structure*. They are claims to the physical assets of the company and as such reflect their value (or others' opinions of their value). Thus, there is an economy wide *financial structure* (composed of the individual asset structures) that is related to and reflects the capital structure of the economy. The capital structure and the capital combinations of which it is composed are in turn related to the plan structure. At each of these levels - plans, physical

---

<sup>10</sup>As Lachmann was to emphasize in his later work, if unexpected changes occur rapidly this tendency may be overwhelmed. This was not something he stressed in his work on capital however.

<sup>11</sup>Compare the remarks of Schumpeter in note 2 above.

assets and financial assets - various institutions exist that help define the various structures. A vitally important institution in the financial structure is the Stock Market. On the Stock Market assets are valued and revalued every day in accordance with companies' performances. The Stock Market reflects a daily balance of expectations concerning the earning prospects of companies. It is probably fair to say that Lachmann considered the Stock Market to be the most important institution of the market economy (he did *not* share Keynes' view that it was basically random in nature, (Lachmann 1956, 68-71 )) and the one, more than any other, that differentiated it from socialized economies - the institution that, together with others in a private financial capital market, was responsible for facilitating the adoption of those capital combinations that produce economic progress (Lachmann 1992).

Capital gains and losses provide entrepreneurs with feedback from the market. Ventures that continue to sustain capital losses will eventually have to regroup or stop operating. In this way the financial structure and the capital structure interact to produce a continuing reshaping of the latter (Lachmann 1956, 94).

#### *Cash balances as excess capacity and constraint*

A more immediate form of feedback comes in the form of changes in the cash balances of the company. The company holds cash as a form of "excess capacity" in order to preserve flexibility. In a sense, cash is the most substitutable of the company's capital assets. Thus changes in cash balances, like changes in inventory, provide an important indicator of the results of the operation over a period of time. A negative cash flow is the ultimate long term discipline and often also the first indicator of a problem<sup>12</sup>. Lachmann sees the traditional neoclassical portfolio approach to cash balance and financial asset holding as misleading. While it is true that production plans must include decisions about financial asset mix (the optimum manner of financing), to assume that *observed* cash and asset portfolios reflect optimal choices is to lose sight of the feedback process discussed above. That is to say, empirically observed changes in cash holdings and asset values reflect not only intended outcomes, they also reflect results that are *unintended* (mistakes or surprises - good and bad). In the portfolio equilibrium view, the portfolio reflects the results of portfolio selection based on underlying preferences and shared knowledge. In Lachmann's (disequilibrium) market process view, the portfolio value reflects portfolio results which are often different from what was intended and cannot be assumed to accurately reflect the preferences and intentions of the planners. Rather it is a barometer of the viability of the overall plan.

Capital gains and losses .... [E]ssentially ... reflect in one sphere events, or the expectation of events, the occurrence of which in another sphere is indicated, and

---

<sup>12</sup>Of course, as a referee has pointed out, negative cash flows occur routinely and are planned for in start up businesses, some of whom go on to become corporate giants. It seems as though a useful distinction between planned and unplanned might be useful here.

knowledge of which is transmitted, by changes in money flows. (Lachmann 1956, 95)<sup>13</sup>.

*All capital accumulation entails a changing capital structure*

Lachmann's capital theory has never been closely examined with a view to its positive implications, for example for economic policy. Perhaps the most important general implication of a disequilibrium approach to capital is the proposition that *all capital accumulation entails a changing capital structure*. This follows from the observation that most technical change is embodied in new (improved) capital goods and/or involves the production of new consumption goods. Capital accumulation that accompanies economic growth as we know it, is not simply the addition of the same kinds of capital goods doing the same things. Lachmann's view of capital accumulation and economic progress is in many ways very prophetic of the revolutionary kind of economic change that has characterized the twentieth century, including the last quarter of the century. It is, in this view, impossible to separate the phenomena of technical progress and capital accumulation; capital accumulation always proceeds hand in hand with technical change. By the same token failed production plans imply "holes" in the capital structure that signal investment opportunities for others. An approach to economic growth that visualizes capital as a homogeneous aggregate to which investment expenditure adds in an indiscriminate way, so that a government policy adding directly to investment expenditure is, in essence no different from an increase in private entrepreneurial investment expenditure, is not only untenable, it has far reaching consequences. The capital structure will be *irreversibly* different in these two cases. It is very likely that government expenditure "crowds out" not only private sector expenditure but also private sector induced technical progress. The shape of the capital structure will be different and, because capital assets are heterogeneous, specific and durable, will remain different from what it would otherwise have been. It takes a lot of faith in the abilities and integrity of the government agents involved to imagine that no sacrifice in entrepreneurial discovery is involved. Lachmann's capital theory framework blends nicely with Kirzner's views on entrepreneurship and Hayek's views on information to yield some very specific insights on "investment policy"<sup>14</sup>.

---

<sup>13</sup>This view of financial portfolios, especially of money holdings, is treated at some length in *Capital* (see chapter VI "Capital Structure and Asset Structure"). But in the lecture notes it is hardly mentioned. This may be because Lachmann delivered a separate section on monetary theory earlier in the year. The latter, however, did not contain any of his ideas on the place of money within the capital combination of the firm as outlined above and in *Capital*. It remains something of a mystery to the present author why he did not follow up on this line of thought, especially since it seems to contain the seeds of a possible integration of monetary and capital theory.

<sup>14</sup>Lachmann's approach also implies that the phenomena of capital accumulation and economic fluctuations are intimately related. The final chapter of *Capital* is devoted to what were then called trade cycle issues. The flavor of this chapter suggests that it was written with 1930's type issues (of depression and recovery) in mind. We find continued

## *Insights and Extensions*

*The disequilibrium method is particularly applicable in a world of rapid changes*

The choice of how to characterize capital is dependent on the kind of world in which one lives. In a world in which unexpected changes occur relatively rarely and in which methods of production, distribution and interaction are very stable, it might make sense to characterize capital as an equilibrium stock, a fund of more or less agreed upon value. But in a world in which change is rapid and unpredictable, Lachmann's characterization of capital as a structure of heterogeneous items, becomes even more appropriate. In particular, with regard to the effect of change on incomes, employment and life styles, Lachmann's changing capital structure gives insights that are not available from an equilibrium approach.

It is generally agreed that we are living in an age of profound changes - some people have called them revolutions. These changes are in one way or another characterized as "changes in technology". It is not the fact of changes in technology that is revolutionary, it is the speed with which it is occurring that is new. The agricultural and industrial revolutions brought with them tremendous strains and stresses in the wake of the changes that occurred. But, by comparison to the changes occurring in our current age, they were minor ripples. The orders of magnitude have multiplied. Also, the pace of change is not only quicker, it is accelerating. At the same time, however, our ability to absorb and adjust to change has increased many fold.

Underlying virtually all of the major developments of this century is the revolutionary change in the way in which we generate and use information hence the phrase "information age". In some respects this is only the latest in a line of similar revolutions like the original emergence of language, the development of writing, accounting and printing. The latest, and to date most profound, development in this line of developments, is electronic communication of which the telephone, the computer and the video and audio recorder are all part. Electronic communication in all of these aspects is responsible for the developments of global markets, of desktop publishing, of fuel injectors for automobiles, of computer aided design of everything from microchips to airplanes, and so on.

To understand the phenomena of accelerating change together with our enhanced abilities to adapt to change we must realize that *the scope and pace of technological change itself is governed by our ability to generate and process relevant information*. This means that the current pace of technical change is dependent on past technical advances, particularly the ability to generate and process information. If technological change is seen as the result of many trial and error selections (of production processes, of product types, of modes of distribution, etc.) then the ability to generate and perceive

---

use to terms like "strong boom" and "weak boom", while terms like "recession" and "stagflation" were not yet invented. By the time he delivered his lectures on capital theory he appeared to have moved beyond these considerations and they appear nowhere in his course materials. Nevertheless, the basic approach contains much that is relevant to a structural view of fluctuations in employment and economic activity. This and other issues are explored in the next section.

more possibilities will result in a greater number of successes. It will, of course, also result in a greater number of failures. Lachmann's proposition that capital accumulation, proceeding as it does hand in hand with technological change, necessarily brings with it capital regrouping as a result of failed production plans, appears in this perspective to be particularly pertinent. "[E]conomic progress ... is a process which involves trial and error. In its course new knowledge is acquired gradually, often painfully, and always at some cost to somebody." (Lachmann 1956, 18). Today new knowledge acquisition is not so gradual.

From the perspective of traditional macroeconomics, with its focus on the money value of investment spending as a gauge of productive activity, it must seem curious that the western economies have gone through a period of rapid capital accumulation and technological advancement at the same time as unemployment frequently remains high. But in an era of rapid technical change this is precisely what one might expect. Capital combinations are made to fit into production plans that assume a particular type of technology. Given that we live in a world where the arrival of the unknown in terms of the technological is almost, paradoxically, to be expected, some flexibility may be built into the plan to accommodate unexpected changes. Whether or not it will be possible to accommodate changes within any production plan, for example by upgrading computer equipment, depends on how large the change is. When very large changes occur the plan may have to be abandoned. The capital in that plan will have to be reassigned or scrapped. This may have ripple effects in so far as this plan is complementary to others. The process of capital regrouping has implications for labor. Labor will be displaced and will have to slot into other capital combinations. Skills acquired for one purpose may be less suited to others. Unemployment is the natural counterpart in labor of multiple specificity in capital. The concept of "human capital" would appear to have ready application in this context and is addressed in the next section.

This kind of structural unemployment, that is to say unemployment caused by the changing of the capital structure as a result of technological change, is obviously not a new phenomenon. The substitution of capital for labor as a result of automation, for example, is well known. Historically speaking the effects of the displacement of labor by capital were easily outweighed by the expansion of production activities. In the current situation, the process is complicated by the rapidity of change and by the increasing complexity of both capital and labor structures. This will be explained further below.

### *Human capital is also capital*

Over the past three or more decades a lot of work had been done on the question of the value of education and training (for example, Becker 1993, Mincer 1974, Schultz 1963). The neoclassical perspective of investment in capital was extended to the context of decision making regarding the enhancement of skills and abilities. Since the payoff to spending on education or training lies in the future it makes sense to regard this spending as a capital investment - specifically an investment in human capital. Under conditions where it is possible to know or to estimate future income streams that are attributable to specific investments in human capital, a rate of return can be calculated. Equivalently, the present value of these investments can be calculated. In this way a picture of the capital stock of the economy that includes the value of skills and abilities emerges.

This approach illuminates much that is relevant about the modern world. Arguably the most important difference between the industrialized and the developing world is the value of accumulated human capital. The quality of an economy's work force goes a long way to explaining its performance. Family size, the distribution of earnings, intergenerational mobility, labor force participation, immigration, and economic growth in general have all been investigated using the framework of human capital investments. Consideration of investments in human capital serves to highlight the nature of the costs involved in all individual decisions. The most important cost in any human capital investment is the value (to the decision maker) of the earnings foregone in choosing to pursue one career, training opportunity, educational course, etc. rather than another. Thus the major cost of producing a doctor, for example, is not the (substantial) tuition cost. It is the value of the earnings foregone by the trainee during the long training period mandated by the medical establishment. This and further insights from this field will be familiar to any student of economics trained over the last few decades.

In Lachmann's work the record is contradictory. Early in *Capital* he suggests that "Capital, [being] distinct from labor and land lacks a 'natural' unit of measurement." (Lachmann 1956, 2). But later on he seems to realize the possible application of his ideas to labor.

[C]apital accumulation is not the only force engendering progress; the division of labor and changes in technical knowledge are others. Sometimes these three forces support each other, but often they offset each other as, for instance, when changing technical knowledge makes *specific skills or specific equipment* redundant .... (1956, 37, italics added).

Again;

[T]echnological progress may cancel some of these effects [of the division of capital] by making some specialized skills and other specific characteristics redundant. 'Technological unemployment' of highly skilled craftsmen is of course a well known manifestation of this tendency. (1956, 126).

Yet his basic stand is clear from the following;

The fundamental difference between labor and capital as 'factors of production' is of course that in a free society only the services of labor can be hired while as regards capital we usually have a choice of hiring services or buying their source, either outright or embodied in titles to control. The chief justification of a theory of capital of the type presented here lies in the fact that in the buying and selling of capital resources there arise certain economic problems like capital gains and losses. (1956, 87n).

The distinction that Lachmann makes here is without substance. The fact that human capital cannot be transferred does not prevent it from being valued in the market by its owners and by its renters. The rental rate will vary directly with the value of the capital (or, more accurately, vice versa). Most important, exactly the same considerations that

apply to the theory of capital and make it interesting in Lachmann's view, apply to human capital. Capital gains and losses most definitely attach to human capital in an uncertain world and are part of the market process of continual reevaluation of production plans. This occurs because human capital like physical capital is heterogeneous in nature.<sup>15</sup> Labor is not a homogeneous, infinitely substitutable stock of services. Rather there exist important and intelligible complementarities between different types of labor as well as between labor and capital. Unexpected changes that affect one type of labor may affect others in a different direction. The development of the desk top computer has increased the demand for computer programmers and PC technicians. But it has rendered the skills of the main frame technician obsolete. The latter has either had to retrain or switch to some other less preferred form of employment. He has suffered a very definite capital loss. Examples like this are plentiful in our present day economy with its apparent tendency toward "recession" amidst rapid technological development and advancing life styles. The workforce is full of unemployed and underemployed Ph.D's and other highly qualified, but specifically skilled, workers. The phenomena of complementarity and multiple specificity apply with full force. The magnitude of the measured unemployed gives an incomplete picture of the forces at work. The *structure* of the unemployed is an important aspect of the problem.

The fact that human capital is extremely durable (it lasts the better part of a life time) renders it vulnerable to rapid and frequent changes. It used to be that a professional qualification (dentist, lawyer, accountant) was a guarantee of job and financial security. Today this is definitely not the case. The world is much more volatile. Technological developments have affected even the apparently most secure professions. The advance of preventative care in the dental profession has dramatically reduced the demand for certain kinds of services, like tooth extraction, fillings, etc. The advance of electronic accounting programs and techniques has reduced the demand for traditional bookkeeping functions. The kinds of skills that are valuable in the world of electronic information are, and are going to be, quite different in nature from those we have relied on in the past. In fact, traditional educational curricula are rapidly becoming obsolete. The phenomenon of ever present change will place a premium on the ability to adapt to change, on being able to

---

<sup>15</sup>Perhaps surprisingly this is clearly recognized by the founder of the concept of human capital who states: "I have argued ... that while a strong case can be made for using a rigorous definition of human capital, it will be subject to the same ambiguities that continue to plague capital theory in general, and the concept of economic growth models in particular. [Particularly problematic] is the assumption, underlying capital theory and the aggregation of capital in growth models, that capital is homogeneous. Each form of capital has specific properties: a building, a tractor, a specific type of fertilizer, a tube well, and many other forms of not only in agriculture but also in all other production activities. As Hicks has taught us, this capital homogeneity assumption is the disaster of capital theory. It is demonstrably inappropriate in analyzing the dynamics of economic growth ...whether capital aggregation is in terms of factor costs or in terms of the discounted value of the lifetime services of its many parts....One of the essential parts of economic growth is thus concealed by such capital aggregation". Schultz 1981, 10-11. It does not seem as though this insight has permeated the human capital literature in general.

recognize opportunities in the capital structure. Thus, preparing our children for the twenty first century will mean equipping them with more than the basic skills of reading, writing, arithmetic and computer programming. We shall have to ensure that they are prepared to change with unforeseen developments. Continuing training throughout one lifetime will probably become more widespread. In short, the rapidly changing capital structure is related to and is, indeed predicated on, rapid changes in the human capital structure.

Lachmann sees economic progress proceeding through the adoption of new and improved technologies embodied in new capital goods. But he recognizes (even moreso in his later work) that this process could not proceed without the arrival of new types of knowledge. The capital goods acquire meaning only in so far as they have perceived uses and in so far as there are people who can put them to use, and this requires human capital. In the same way as there are important complementarities between different capital goods, there are complementarities between different types of knowledge and between knowledge and physical capital. Knowledge must be embodied in human labor. The human capital structure is inseparable from the capital structure in general - the capital structure incorporates human capital.

[T]he problem-solving character of the interpretation of information resides in the need to fit particles of the information flow to an existing stock of knowledge. In the simplest case the modification of the latter takes the form of a mere addition to it. Most of the cases we find in the literature, in which the information newly gained concerns as a rule cheaper sources of supply or more profitable market opportunities, appear to fall into this category. But it is readily seen that such single items are less valuable than those which are complementary to an item already known. *The case is parallel to one in the theory of capital: investment is the more rewarding the more it is complementary to some existing capital goods. Our understanding of both cases and their implications demands an awareness of the relevance of heterogeneity and its modes as regards the capital stock as well as the stock of knowledge.* (Lachmann 1986, 51, italics added)

*The market process has discernible phases: imitation and innovation*

The market process is one of continual flux. The shaping and reshaping of the capital structure is driven by the changing shape of the mix of consumer products. This perspective led Lachmann to a characterization of market activities in terms of two distinct phases. "A competitive process taking place within the market for a good consists typically of two phases, and in it the factors of innovation and imitation may be isolated as iterative elements". (Lachmann 1986, 15). The successful introducer of a new product or new brand of product gains temporary monopoly power. The spreading knowledge of his success attracts imitators. The learning curve for the latter is shorter. Prices tend to fall as margins are competed away. This brings further pressure for product differentiation and capital reshuffling (reorganization). The process is inseparable from technological change. Market share and firm size at any point of time thus have very little to do with monopoly power. They are both transitory states of a continuing innovation-imitation



cycle. This view finds close application in the electronics industry and the development of personal computers, fax machines, copy machines, cameras, cellular phones and so on. Notably the innovation-imitation cycle is shortening. This is another aspect of the rapidity and acceleration of change. From this perspective the classical doctrine of capital flows establishing a uniform rate of profit is found wanting.

*The relationship between capital and complexity is complex*

An important aspect of the information revolution is that it allows for the formation and management of ever more complex capital structures. In his work on capital Lachmann proposed a reinterpretation of a controversial aspect of Böhm Bawerk's theory, his famous proposition concerning the superior productivity of roundabout production (i.e. of production process that are more indirect, that take more "production time") (Lachmann 1956, chapter V). Lachmann regarded Böhm Bawerk's use of time as a unit of measurement for the capital stock as untenable and seriously misleading<sup>16</sup>. He felt strongly, however, that Böhm Bawerk's intuition about the sources of economic progress was correct. "[T]he intuitive genius of Böhm Bawerk gave an answer [that], to be sure we cannot fully accept and which, moreover, is marred by an excessive degree of simplification, yet an answer we cannot afford to disregard." (1956, 73). Therefore he suggests dispensing with the notion "period of production" and replacing it with the notion "degree of complexity". Whereas Böhm Bawerk argued that the period of production increased with capital accumulation, Lachmann argues that capital accumulation results in the increasing complexity of the production process. In this way he hoped to have given a new and more appropriate meaning to the notion of increased roundaboutness.

Lachmann argued that Böhm Bawerk's ideas were closely related to those of Adam Smith (1956, 79). Both were concerned about the sources of economic progress. Both lived in a world that was "neither a stationary nor a fully dynamic world" (1956, 79). Our world is, however, a dynamic world, one in which technical progress is an outstanding feature. For Böhm Bawerk roundaboutness was not a form of technical progress. "Technical progress requires new forms of knowledge spreading through the economic system while Böhm Bawerk assumes as given knowledge equally shared by all."(1956,79).

For Adam Smith the division of labor was the most important source of progress. The same principle can be applied to capital. As capital accumulates there takes place a 'division of capital', a specialization of individual capital items, which enables us to resist the law of diminishing returns. As capital becomes more plentiful its accumulation does not take the form of multiplication of existing items, but that of a change in the composition of capital combinations. Some items will not be increased at all while entirely new ones will appear on the stage.... The

---

<sup>16</sup>This is something he explained at length in his lectures. In order to calculate the average period of production, one is required not only to identify definite starting and ending points for each production process, one is also required to formulate each production process in terms of physically defined input, outputs and the elapse of time between them. This is only possible in a world where unexpected change is absent and where all production techniques are known in this way. This implies that all production plans are consistent with one another. For a clear explanation of the concept 'average period of production' and its dependence on the rate of interest see Lutz 1966, chapters I-III.

capital structure will thus change since the capital coefficients change, almost certainly towards a higher degree of *complexity* i.e. more capital items will now be included in the combinations. The new items, which either did not exist or were not used before, will mostly be of an indivisible character. *Complementary plus indivisibility* are the essence of the matter. It will not pay to install an indivisible good unless there are enough complementary capital goods to justify it. Until the quantity of goods in transit has reached a certain size it does not pay to build a railway. A poor society therefore often uses costlier (at the margin) means of transport than a wealthier one. The accumulation of capital does not merely provide us with the means to build power stations, it also provides us with the means to build factories to make them pay and enough coal to make them work. Economic progress requires a continuously changing composition of social capital. The new indivisibilities account for the increasing returns. (1956, 79-80, italics original).

Böhm-Bawerk's thesis about the higher productivity of roundabout production is an empirical generalization. It can be applied, reinterpreted, to our own world. We have achieved, and will continue to achieve, greater productivity, that is the production of more and better consumption goods and services, by the continuing introduction of new indivisible production goods (which embody new production techniques). This can be cast in terms of Böhm-Bawerk's idea of "stages of maturity". Böhm-Bawerk argued that capital accumulation will take the form of an increase in the number of stages of production. "The richer a society the smaller will be the proportion of capital resources used in the 'later stages of production', the stages nearest to the consumption end, and vice versa." (Lachmann 1956, 82). Lachmann recasts this idea to mean that progress implies that capital accumulation results in an increase in the number of processing stages as capital combinations become more and more specialized. He is careful to point out that this will only imply an increase in the actual time of production (however calculated) if it can be assumed that each "stage" is of equal duration. This is not likely to be the case and so unlike Böhm-Bawerk we must give up the hope of measuring production processes in terms of time. The increased number of stages is indicative of increased complexity, which, in turn, is indicative of increased productivity. Increased complexity implies "an ever more complex pattern of capital complementarity" (ibid. 85).

We conclude that the accumulation of capital renders possible a higher degree of the division of capital; that capital specialization as a rule takes the form of an increasing number of processing stages and a change in the composition of the raw material flow as well as of the capital combinations at each stage; that the changing pattern of this composition permits the use of new indivisible resources; that these indivisibilities account for increasing returns to capital; and that these increasing returns to the use of capital *are*, in essence, the 'higher productivity of roundabout methods of production'. (84-5, italics original).<sup>17</sup>

---

<sup>17</sup>The reference here to increasing returns is especially noteworthy in light of the current rediscovery of the phenomenon in the context of a variety of new initiatives in economics.

Finally, Lachmann contends that the increased complexity of the capital structure also implies an increased vulnerability. "A household with six servants each of whom is a specialist and none of whom can be substituted for another, is more exposed to individual whims and the vagaries of sickness than one that depends on two or more 'general maids'. Thus an 'expanding economy' is likely to encounter problems of increasing complexity....[among which are] disproportionalities and the resulting maladjustment of the capital structure [which] may give rise to serious problems in economic progress." (85).

What are we to make of these assertions? One way to think about the capital structure becoming more complex is to see an increase in the degree of vertical disintegration. More and more stages of production are associated with any production process. Complexity implies a large number of components - in this case stages. Increasing complexity then implies that the number of stages increases. The production activities become more and more finely specialized. This development is facilitated by the growth in economic activity. As Adam Smith would have it specialization is limited by the extent of the market. Lachmann has given fuller expression to this idea through the idea of capital complementarity. A possible objection to this line of thought is provided by noting that the whole character of production processes changes with technological change. In some instances vertical integration may increase not decrease. For example, in the computer industry, large scale production and consumption of personal computers, peripherals and software has provided economies of scale in the distribution of these products so that it has become possible in many cases to dispense with the services of the distributor middleman. An entire stage in the production-distribution cycle has been cut out. There are undoubtedly other examples of this. New production processes may imply fewer stages. This raises the difficult question of what we should regard as constituting a production stage. There are arguably more components in an old main frame computer than in a modern desk top. However, the number of circuits in a modern microprocessor (CPU) is many times that in the old main frame. Which has more "stages" of production? Another problem is presented by the production of completely new products and the disappearance of old ones. From what perspective could we ever measure, or should we ever try to measure, the number of production stages for the economy as a whole? We seem to be back to capital measurement problems.

Yet, there is an inescapable intuitive ring of truth to Lachmann's (and Böhm Bawerk's) attempt to characterize progress as increasing complexity. This is, in fact, very much in line with recent developments in other fields of inquiry, like biology, physics, population studies, weather, and others (Waldrop 1992). In each of these fields investigators have turned their attention to what they characterize as *complex systems*. A

---

These include the new focus on non linear economics (Day and Chen, 1992), the economics of "lock in" (Arthur 1989), institutions and economics and evolution and economics (Hodgson 1988, 1992). Economists are now beginning to place greater emphasis of the importance of particular historical events in explaining the emergence of technologies in a manner that Lachmann clearly foreshadowed in his capital theory. On the topic of increasing returns see Buchanan and Yoon 1994.

complex system is one that has a great many independent agents that are interacting with each other in a great many ways. Moreover, the very richness of these interactions allows the system as a whole to undergo spontaneous self organization and to adapt to changes. Notably, "every one of these complex, self-organizing, adaptive systems possesses a kind of dynamism that makes them qualitatively different from static objects". (Waldrop 1992, 11-12). Market economies in general and capital structures, as characterized by Lachmann, definitely constitute complex systems in this sense. (See also Hayek, 1964). In what way are they becoming more complex? Perhaps the key is to be found in the continuing arrival of new information leading to new knowledge. Capital accumulation in the modern world implies the accumulation of information and the addition to knowledge. To be sure, some knowledge may be lost. For example, modern man could not last very long in the wilderness unaided, in the manner of his more primitive forebears. Also certain kinds of "wisdom" may be lost as lifestyles change. However, modern man can, in an obvious sense, accomplish more things. Our current knowledge is of a "higher" order. It rests on the multitude of advances (and mistakes) made across countless generations. In that way we reap the benefits of more "roundabout" production.

### *Conclusion*

Ludwig Lachmann's capital theory was an important part of his life's work. Yet, even among those who are familiar with his work, this is perhaps his least well known and least discussed contribution. I have tried to show that this work is of continuing relevance. A conception of the capital structure in terms of a disequilibrium process is strikingly in tune with the monumental changes that have occurred in the economies of the twentieth century. Lachmann's framework provides a way of understanding these changes. In addition, his vision is capable of being profitably extended to encompass a wider notion of capital, one which includes human capital. A disequilibrium framework is one in which indivisibilities provide opportunities for increasing returns. New and valuable information is perhaps the most important source of such indivisibilities. A disequilibrium framework is also one in which "history matters". The particular path that a technological development takes is bound to influence the future developments related to it. The capital stock that we inherit reflects both the decisions of the past (good and bad) and the constraints of the present.

### References

- Arthur, W.B. 1989. Competing Technologies, Increasing Returns and Lock In by Historical Events. *Economic Journal*. 99: 116-31.
- Becker, G.S. 1993 *Human Capital*. third edition. Chicago: University of Chicago Press.
- Buchanan, J. M. and Y.J. Yoon. ed. 1994. *The Return to Increasing Returns*. Ann Arbor: University of Michigan Press.
- Day, R. H. and Ping Chen. 1993. *Nonlinear Dynamics and Evolutionary Economics*. Oxford: Oxford University Press.
- Grinder, Walter E. ed. 1977. *Capital Expectations and the Market Process: Essays in the Theory of the Market Economy By Ludwig M. Lachmann*. Kansas City: Sheed Andrews and McMeel.
- Hayek, F.A. 1939. *Profits Interest and Investment*. London: Routledge. Reprint. New York: Augustus M. Kelly, 1969.
- \_\_\_\_\_. 1941. *The Pure Theory of Capital*. Chicago: University of Chicago Press.
- \_\_\_\_\_. 1964. The Theory of Complex Phenomena in F.A. Hayek, *Studies in Philosophy, Politics and Economics*. London: Routledge & Kegan Paul.
- Hodgson, G.M. 1988. *Economics and Institutions: A Manifesto for Modern Institutional Economics*. Philadelphia: University of Pennsylvania Press.
- \_\_\_\_\_. 1993. *Economics and Evolution: Bringing Life Back Into Economics*. Ann Arbor: University of Michigan Press.
- Kirzner I.M., 1966. *An Essay on Capital*. New York: Augustus M. Kelly.
- \_\_\_\_\_. ed. 1986. *Subjectivism, Intelligibility and Economic Understanding: Essays in Honor of Ludwig M. Lachmann on his Eightieth Birthday*. New York: New York University Press.
- Lachmann, L.M. 1938. Investment and Costs of Production. *American Economic Review*, Sept. 469-81. Reprinted in Lavoie 1994, 42-56.
- \_\_\_\_\_. 1939. On Crisis and Adjustment. *Review of Economics and Statistics*, 62-8. Reprinted in Lavoie 1994, 76-90.
- \_\_\_\_\_. 1941. On the Measurement of Capital. *Economica*, May 367-77. Reprinted in Lavoie 1994, 91-106.
- \_\_\_\_\_. 1944. Finance Capitalism, *Economica*, Nov. 64-73. Reprinted in Lavoie 1994, 107-123.
- \_\_\_\_\_. 1947. Complementarity and Substitution in the theory of Capital. *Economica*, 14: 108-19. Reprinted in Grinder 1977, 197-213.
- \_\_\_\_\_. 1948. Investment Repercussions, *Quarterly Journal of Economics*, Nov. 697-713. Reprinted in Lavoie 1994, 131-146.
- \_\_\_\_\_. [1956] 1978. *Capital and Its Structure*. (Second edition, reprint) Kansas City: Sheed Andrews and McMeel.
- \_\_\_\_\_. 1986. *The Market as Economic Process*. Oxford: Basil Blackwell.
- \_\_\_\_\_. 1992. Socialism and the Market: A Theme of Economic Sociology Viewed from a Weberian Perspective. Unpublished paper. *South African Journal of Economics*. 60: 24-43.
- Lavoie, D. ed. 1994. *Expectations and the Meaning of Institutions: Essays in Economics by Ludwig Lachmann*, New York: New York University Press.

- Lewin, P. 1994. Knowledge, Expectations and Capital: The Economics of Ludwig M. Lachmann, *Advances in Austrian Economics*, Volume 1, 233-256.
- Lutz. F.A. 1967. *The Theory of Interest*. Dordrecht, Holland: D. Reidel Publishing Company.
- Mincer, J. 1974. *Schooling, Experience and Earnings*. New York: Columbia University Press.
- Schultz, T.W. 1963. *The Economic Value of Education*. New York: Columbia University Press.
- \_\_\_\_\_. *Investing in People: The Economics of Population Quality*. Berkley: University of California Press.
- Schumpeter J.A. 1912. *The Theory of Economic Development*. Trans. Redvers Opie. Cambridge: Harvard University.
- \_\_\_\_\_. 1954. *History of Economic Analysis*. New York: Oxford University Press.
- Shmanske S., 1994. On the Relevance of Policy to Kirznerian Entrepreneurship *Advances in Austrian Economics*, Volume 1, 199-222.
- Waldrop, M.M. 1992, *Complexity: The Emerging Science at the Edge of Order and Chaos*. New York: Simon and Schuster.
-