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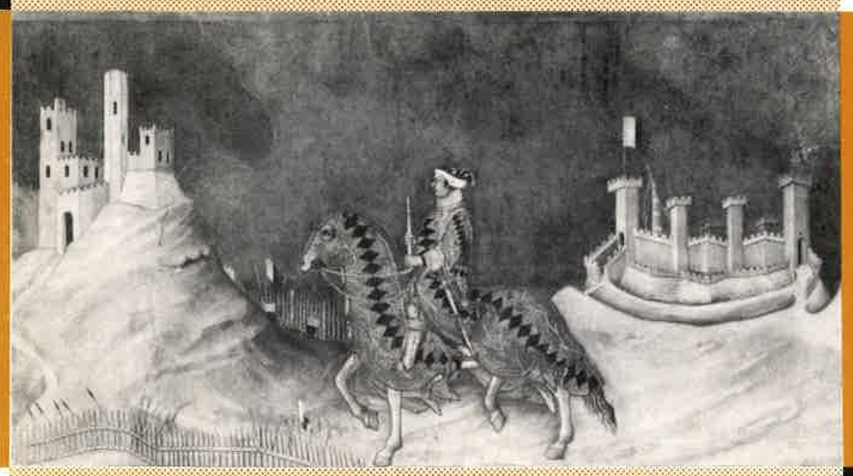
QUADERNI DELL'ISTITUTO DI ECONOMIA

Alessandro Vercelli

KEYNES, SCHUMPETER, MARX AND THE STRUCTURAL INSTABILITY OF CAPITALISM



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Alessandro Vercelli

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*In this paper we will focus our attention on a crucial element of heterodoxy common to Keynes, Schumpeter and Marx: the concept of instability of a monetary economy. Orthodox economists always believed in the fundamental stability of capitalism. This opinion has been challenged by our three authors in a few essential articulations of their theories. Still, not surprisingly, the role of instability in their thought is systematically played down by orthodox interpreters. Keynesian instability is understood as stochastical or cyclical instability, not affecting the basic average stability of trend movements. Schumpeterian instability is interpreted as temporaneous cumulative divergence from equilibrium in the expansionary phase of the cycle. And Marxian instability is seen as on ephemeral epiphenomenon of stable long-term tendencies. We would like to show that these traditional interpretations are highly reductive.

We are ready to recognize that the very few interpreters that have stressed the role of instability in a monetary economy have met with difficult obstacles, but we believe that it is possibile to overcome them. To succeed in this task, we need the help of a new specification of the concept of instability: structural instability, i.e. the disposition to discontinous structural changes induced by perturbations. As a matter of fact, heterodox interpreters share with the orthodox ones the same standard concept of instability: dynamical instability, i.e. the tendency of a system to diverge progressively from equilibrium whenever disturbed. This concept is inadequate to vindicate a fundamental role for instability in the theory of a monetary economy. Divergent processes have to be conceived as bounded in their domain and/or speed (unless we believe that a complete collapse of the economic system may be round the corner), but these bounds inevitably limit also the scope and role of economic instability. We will try to show in this paper that the instability of capitalism in the sense of Keynes, Schumpeter and Marx cannot be properly understood without introducing the aforementioned concept of structural instability.

This acquisition will help us to understand many other heterodox features of our three authors. This is particularly true of the organic relation between cycle and growth which characterizes their contributions. The analysis of economic cycles cannot be severed from the analysis of growth, because cycles and growth crucially interact in a structurally unstable economic structure, which is typical of any monetary economy and especially of developed capitalism. Each of our three authors reacted, though in different ways, to the traditional mainstream view according to which we may distinguish two sets of economic forces, respectively determining cycles and growth. The first set of forces should, in this view, explain disequilibrium cyclical movements around equilibrium trends whose dynamics is explained by the second set of forces. Disequilibrium dynamics is conceived as not affecting equilibrium trends so that we may study cycles and growth separately. The relation between the two sets of forces is then often rationalized through the distinction between short-period and long-period where short-period precisely excludes growth from the scope of analysis, while long-period excludes business cycles and all other disequilibrium movements. We will try to show that, in the theory of our three authors, the relation between short-period and long-period as well as between cycle and growth has to be considered in a completely different perspective. The structural instability of a monetary economy implies a relevant feed-back between short-period and long-period as well as cycle and growth.

We will now analyze our three authors in the following order: Keynes, Schumpeter and Marx, progressively broadening the scope of the analysis from a shorter to a longer period. We will concentrate our attention exclusively on a few crucial aspects of the interrelation between cycles and growth which are connected to money, credit and technical change. We will be able to detect a basic common idea: the capitalistic economic system is structurally unstable and the main explanation of this lies in the properties of

money and credit. Unfortunataly, for the sake of brevity, we have to neglect almost completely the well-known features that sharply distinguish the "visions" and the theoretical systems of these three authors.

1. Structural and dynamical (in)stability

Before entering *in medias res* we will briefly recall a few basic concepts which we will define in the most elementary way.

We have, first of all, to make a clear distinction between dynamic and structural instability. Both definitions are founded on the observation of the behaviour of a system perturbed by a disturbance. A disturbance is simply any transformation, endogenous or exogenous, impinging on a system. Dynamic (in)stability, as is well-known, is about convergence (or divergence) of the behaviour of a perturbed system to (or from) equilibrium. This concept is by now well-established in economic theory and does not need, for our purposes, any further comment.

Structural (in)stability is about qualitative (or structural) change of the behaviour of a perturbed system. If qualitative change in the behaviour of the system exceeds a certain preassigned minimum standard, the system is said to be structurally unstable. This depends on a) the kind and size of the disturbance; b) the standard chosen to define the change induced in the system as qualitative (or structural) rather than merely quantitative. Clearly enough, a system may have different degrees of structural instability according to the relation between the size of the disturbance and the qualitative characteristics of the system's response (in the formal model this depends on the definition of a) the admissible perturbations, b) the concept of system equivalence, c) the topology adopted)[1].

We will find it useful in this paper to think of the economic system as represented by a flow-diagram. The economic structure is then given by the "functional structure" of the system, that is the ordered set of functions contained inside the blocks. Any discontinuous change of the functional

structure of the system implies a qualitative change of the system's behaviour. In this case we are, in principle, bound to find a sizable change in its equilibrium properties, which may involve its uniqueness and determinateness, and a sizable change in disequilibrium behaviour (see appendix).

The rigorous definition of structural (in)stability is rather recent. It was first formulated by Andronov and Pontryagin in a seminal paper of 1937 (the history of the concept, its precise meaning and its methodological implications are analized in some detail in the appendix to Vercelli, 1984). A conscious and explicit application of the concept to economics is much more recent and not altogether satisfactory (see Vercelli, 1982). Still, I believe that the concept of structural (in)stability, suitably mended and worked out, will play a very important role in economics as well as in other social sciences where the main problem is often that of explaining and perhaps forecasting structural changes. Unfortunately, the modern formalized version of the concept has not yet been reshaped to fit the specific problems of economics. This is a research target of the greatest importance. As a preliminary step in this direction,we will try to show,first of all, that the analysis of capitalistic instability suggested by Keynes, Schumpeter and Marx may be better modelled, in many crucial steps of the analysis, as structural instability rather than dynamic instability. Moreover, we will find in these classical texts a few useful suggestions for working out a revised version of the concept of structural (in)stability more suitable for economics.

2. Keynes

One of the main interpretative paradoxes in the *General Theory* of Keynes is about the instability of capitalism. He vigorously challenges the "classical" vision of capitalism (actually of any "monetary economy") as a system able to self-adjust to stable full employment equilibrium[(2)]. He contends that only a barter economy may have this property. On the contrary, a monetary economy is defined, already in the introduction, as "essentially

one in which changing views about the future are capable of influencing the quantity of employment and not merely its direction" (Keynes, 1936, p. xxii).

All that has led part of the interpreters to stress the Keynesian views on the instability of capitalism by modelling them in terms of dynamic instability. So, for example, Minsky contends that "during each short-period equilibrium, in Keynes's view, processes are at work which disequilibrate the system. Not only is stability an unattainable goal; whenever something approaching stability is achieved, destabilizing processes are set off" (Minsky, 1975, p. 61). Keynesian economics is then interpreted as the "economics of permanent disequilibrium" (ibid., p. 68), owing mainly to the influence of "financial instability". The trouble with this kind of interpretation is that Keynes, although stressing in a loose but compelling way the instability of capitalism, takes some pains[(3)] to explain why capitalism is after all "substantially stable":

"it is an outstanding characteristic of the economic system in which we live, that, whilst it is subject to severe fluctuations in respect to output and employment, it is not violently unstable. Indeed it seems capable of remaining in a chronic condition of sub-normal activity for a considerable period without any marked tendency either towards recovery or towards complete collapse" (Keynes, 1936, p. 249).

A monetary economy is thus characterized by an area, reasonably limited, of real and monetary values inside which dynamic instability may play a role[(4)], even an important one, but this area, considered as a whole, is dynamically stable. These observations by Keynes have till now severely jeopardized all the interpretations centered around the instability of capitalism. Mainstream interpretations of Keynesian theory (first of all those proposed by supporters of the "neoclassical synthesis") were able to exploit these arguments to rebutt the heterodox interpretations. But their view of full employment equilibrium as dynamically stable (although admitting, at the

same time, that the adjustment process may be very slow) does in its turn unduly neglect Keynes' recurrent insistence on the instability of a monetary economy.

We believe that we may find a way out of this paradox. Dynamic instability is not the only possible way of modelling actual instability. A deeper analysis of Keynesian contributions suggests a different specification in terms of structural instability. We tried elsewhere (Vercelli, 1981) to develop at some length the outlines of an interpretation of this kind. We will only try here to recall briefly a few points without any attempt to demonstrate them.

Each element of the set of admissible equilibria (full employment equilibrium and unemployment equilibria) may be considered in itself as a dynamically stable equilibrium. The main analytical targets of General Theory are: a) to show what determines one of these possible equilibria and b) what determines the shift from one equilibrium to another. Keynes is able to show that each equilibrium is associated with different economic policy rules and that a change in them determines a shift of the equilibrium position. The reason must be found in the influence exerted by different economic policy rules on the functional structure of the economy (mainly characterized by consumption propensity, marginal efficiency of capital and liquidity preference)(5). We do not mean here either stochastic shifts, or cyclical shifts around an unchanging average, but shifts in their "long-run" position. We may thus understand why Keynes feels justified in repeating that:

"In my view, there is no unique long-period position of equilibrium equally valid regardless of the character of the policy of the monetary authority. On the contrary there are a number of such positions corresponding to different policies" (Keynes, C.W. XXIX, p. 54-55) (6).

An alteration of monetary policy rules would affect the functional structure of the system in a "permanent" way, until another modification

in monetary policy rules intervenes to change it again.

The same kind of reasoning is developed with reference to the repercussions of a change in money wages, mainly analysed in the famous passages of ch. 19, which are crucial for a proper understanding of the entire *General Theory*. A reduction of money wages in a situation of unemployment equilibrium is not enough, generally speaking, to restore full employment and anyway is not preferable to a policy of money inflation, because it would affect in a decisive way the functional structure of the economic system:

"The reduction in money-wages will have no lasting tendency to increase employment except by virtue of its repercussion either on the propensity to consume for the community as a whole, or on the schedule of marginal efficiencies of capital, or on the rate of interest" (Keynes, 1936, p. 262).

The induced shifts of the three psychological functions displace the equilibrium position but probably in a perverse direction(7).

To sum up the preceding discussion, we may observe, first of all, that we could interpret a change in economic policy rules as a change of the environment in which a market economy happens to operate. We may thus consider such an event as a disturbance, or better, a change in the structure of disturbances affecting the economic system. We are thus justified in applying rigorously to the preceding Keynesian arguments the modern concept of structural instability. We may then observe that a capitalist economic system is structurally unstable because even a small disturbance, either endogenous or exogenous, affecting over-sensitive and conventional expectations, is liable to generate a considerable qualitative change in its behaviour.

3. Schumpeter

We have seen in the *General Theory* a sort of short-term structural instability mainly connected with different economic policy rules. Its relev-

ance is not only restricted to its crucial influence on the choice of the best economic policy rules, but also applies to the longer-term structural influence on production conditions through technical change embodied in investment decisions. This topic in only hinted at in the *General Theory*, but it is not systematically analyzed because of the self-imposed bounds implied by short-period assumptions(8).

The nexus between entrepreneurial investment, business cycles and development is, on the contrary, at the center of Schumpeter's contribution. We are of course compelled, from the very outset, to break the strait-jacket of short-period, because the main object of Schumpeterian analysis, the relation between innovation and Capital accumulation, cannot even be defined without dropping the assumption of constant capital stock. As is well-known clusters of innovations explain at the same time cycles and development. Any boom induced by a swarm-like wave of innovations is characterized by a discontinuous structural change setting the pace and direction of growth. These recurring structural changes are "the only fundamental cause of instability inherent to the capitalist system" (Schumpeter, 1928, p.385).

But what does Schumpeter mean by instability? Certainly not dynamic instability, in the usual meaning of the word. The effects of a wave of innovations should not be described, according to Schumpeter, as a progressive divergence from equilibrium but as a destruction of equilibrium. The old equilibrium does not rule economic behaviour any more and a new one is not yet established. Any autonomous structural change endoge nously displaces the equilibrium position. However, in the boom endogenous structural change is so rapid and discontinuous that the equilibrium position is unable to exert any detectable influence on economic behaviour. This means that, during a boom, while a swarm of innovations causes the economic structure to "implode", there is not much point in using the equilibrium concept:

"we will not postulate the existence of states of equilibrium where none exist, but only where the system is actually moving toward one. When, for instance, existing states are in the act of being disturbed, say, by a war financed by government fiat, or by a 'mania' of railroad building, there is very little sense in speaking of an ideal equilibrium coexisting with all that disequilibrium. It seems much more natural to say that while such a factor acts there is no equilibrium at all. When it has ceased to act, and when we observe that readjustment sets in which we interpret as a movement toward equilibrium, then and only then the ideal equilibrium becomes the goal of an economic process, the nature of which can be elucidated by reference to it. Then and only then the equilibrium becomes what we have called it before, the 'theoretical norm' of the economic variables. Hence, we will, for our purpose, recognize existence of equilibrium only at those discrete points on the time scale at which the system approaches a state which would, if reached, fulfill equilibrium conditions" (Schumpeter, 1939, pp. 70-71).

As we can see, we cannot interpret Schumpeter's instability as dynamical instability. On the contrary, we may today naturally reappraise his instability concept as an early and particularly lucid definition of structural instability. We could not, of course, refer to the mathematical definition of the concept which was not yet worked out in a rigorous way. Schumpeter's concept may be found at least since the first edition of *The theory of economic development* (1911), while the first rigorous mathematical definition was given, as we have seen, only much later. Still the concept expressed by the great Austrian economist is surprisingly similar, even in language, to the modern mathematical concept. As a matter of fact, by instability Schumpeter means a discontinuous qualitative change in economic structure (or economic behaviour, which is the same thing), induced by inherent disturbances.

This definition may be clearly understood as a specification of the current standard definition of structural stability. The specific traits requiring a comment are the following:

a) qualitative change is defined as a discontinuous "change in the channels of the system" (Schumpeter, 1934, p.82). We may notice the analogy, even in the language, with the definition of structural change given in the second paragraph (see the appendix for a further clarification of the issue). In our language the change of channels becomes a change in the

flow structure and the change in economic data a change in the parameters (appearing in the blocks).

b) The conceptual "topology" put forward for identifying qualitative change is not too "fine". Schumpeter is careful in excluding from his instability concept minor and/or continuous qualitative changes:

"what we are about to consider is that kind of change arising from within the system which so displaces its equilibrium point that the new one cannot be *reached from the old one by infinitesimal steps*. Add successively as many mail coaches as you please, you will never get a railway thereby" (Schumpeter, 1934, p.64, n. 1).

On the contrary, a relevant qualitative change is often defined as "destruction" of the preceding equilibrium or structure.

c) The trigger-mechanism of structural change is always defined as a disturbance, exactly as in the modern definitions of structural instability:

"innovations cluster densely together. So densely, in fact, that the resultant disturbance produces a distinct period of adjustment - which is precisely what the depression phase of the business cycle consists in" (Schumpeter, 1928, p.382).

d) In most of his contributions, he restricts the class of relevant disturbances to "inner" or "economic" disturbances only, because he is interested first of all in analyzing the inherent structural instability of the economic system.

e) Inner disturbances of the economic system induce structural change in two distinct phases. In the boom structural change is accompanied, as we have seen, by an absence of equilibrium, while in the depression structural change is accompanied by the reappearance of a new stable equilibrium, i.e. it goes together with dynamic stability. We have thus in both phases structural instability but of a different kind: in the boom a "creative" structural instability, in the depression an "adaptive" structural instability (not to be confused with dynamic stability).

f) The well-known results springing from Schumpeterian analysis of structural instability of Capitalism are that "there is, through instability of the *System*, no economic instability of the *Order*" (1928, p.384), where capitalist *order* means "the institutional survival of capitalism" and capitalist *system* means "business conditions" (ibid., p.363). Moreover, as a consequence of "trustified" capitalism, swarm-like innovations, that is "the only fundamental cause of instability inherent to the capitalist system, is losing importance as time goes on, and may even be expected to disappear" (ibid., p.385). Capitalist order "whilst economically stable, and even gaining in stability" is unstable for other non-economic reasons too well-known to be recalled here.

The preceding observations suggest *inter alia* that not only Schumpeter may be considered as a lucid forerunner of the concept of structural instability, but that he also began a much needed effort of adaptation of the concept to the specific exigencies of economic and social analysis.

We may particularly appreciate the following suggestions:

a) the current concept of structural instability, defined broadly speaking as discontinuous structural change induced by a small disturbance, is too generic a concept for economic analysis. We have to distinguish between different categories of disturbances not only of various intensity but also of various qualitative kind (external, internal, affecting the flow structure or the functional coefficients, etc.). Engineers and mathematicians, who worked out the modern version of the concept, neglected these issues because their main problem was and is very often that of maximizing the stability of an optimal behaviour (we may think, for instance, of the performance of an airplane), so that any structural change, whatever the nature of the disturbance, might be disruptive and should be avoided. Unfortunately economic problems are much more complex and need a much more sophisticated concept of structural instability.

b) Economic reality may be considered as a hierarchical system articulated in many subsystems, of which the lower is strongly affected by the higher and weakly affects it in its turn, so that it could change even radically without much disturbing the higher system. This is the case, for example, of the Schumpeterian distinction between capitalistic *order* and capitalistic *system*, the first being the higher system and the second the lower. A hierarchical system may have a different degree of structural instability in each of its subsystems, which might affect in interesting (but unexplored) ways its overall dynamic behaviour.

4. *Marx.*

Nobody would deny that structural change is at the center of Marxian analysis. Still, to be able to relate his contribution to the modern concept of structural instability, we apparently lack, the other ingredient: disturbances. Structural change is typically related not to disturbances but to internal contradictions.

We cannot even try to propose here a satisfactory interpretation of the Marxian notion of contradiction. We are thus compelled to begin with an assumption (which we tried to argue elsewhere: Vercelli, 1973 and 1979): in many instances Marxian dialectical language may be reasonably well translated in the more usual language of system dynamics. We may then interpret a "latent" contradiction as an equilibrium and an "open" contradiction as a "disequilibrium". Structural change is typically related to the concept of adequacy. A "metamorphosis" occurs when a form (a structure) happens to become intolerably inadequate to fulfill one of its vital targets. Adequacy may be simply modelled as an equilibrium between a certain performance norm and actual performance, and a growing inadequacy as a growing disequilibrium. When a cumulative disequilibrium process goes beyond a certain threshold, structural change is induced: "merely quantitative differences beyond a certain point pass into qualitative changes" (K. II., p.309).

We cannot, here, try to argue the plausibility of the interpretation so briefly outlined, but we may exemplify. Let us consider the following statement:

"the exchange of commodities implies contradictory and mutually exclusive conditions. The differentiation of commodities into commodities and money does not sweep away these inconsistencies, but develops a modus vivendi, a form in which they can exist side by side. This is generally the way in which real contradictions are reconciled. For instance, it is a contradiction to depict one body as constantly falling towards another, and as, at the same time, constantly flying away from it. The ellipse is a form of motion which, while allowing this contradiction to remain, at the same time reconciles it" (K. I., p. 103-104).

If the dynamical forces of the system, centripetal and/or centrifugal, change, the ellipse too has to change into a different ellipse or, more radically, into an altogether different kind of form: a parabola or a hyperbola, for example. Structural change is here related with easily identifiable thresholds in the relation between the dynamic forces of the system. We may thus interpret disequilibrium (typically when it exceeds a certain threshold) as a sort of endogenous disturbance inducing structural change. We are then put not only in the position of applying to the Marxian theory the modern concept of structural instability, but also of coordinating it with the concept of dynamic instability. The internal disturbance leading to structural change is typically induced by dynamic instability itself[9].

Our interpretative hypothesis has been till now exemplified by an exceedingly simple case, drawn from the natural world. As soon as we consider an economic structure, dynamic and structural characteristics become so complex as to make it difficult, even for Marx, to be as clear as he was in the preceding example. Still, we believe that we can also find the same basic concepts in the more complex analysis of the capitalist world. We will try to exemplify again. For the sake of comparison with Schumpeter but also with Keynes, we have chosen the process of technical change under

capitalism.

Firstof all, Marx knows very well that technical change is a crucial aspect of modern capitalism:

"Modern industry never looks upon and treats the existing form of a process as final. The technical basis of that industry is therefore revolutionary, while all earlier modes of production were essentially conservative" (K. I., p. 486).

But to allow this continuous process of structural change, capitalism needs a high degree of flexibility for:

a) *labour:* "Modern Industry, by its very nature, therefore necessitates variation of labour, fluency of function, universal mobility of the labourer" (K. I., p. 487).

b) *capital,* as is already clearly shown by the process of centralization which "intensifies and accelerates the effect of accumulation" and "simultaneously extends and speeds those revolutions in the technical composition of capital which raise its constant portion" (K. I., p. 628). In other words capitalism needs a high degree of structural instability in the productive process.

This is assured for labour, as is well-known, by the reserve army mechanism and for capital by the development of credit:

"With capitalist production an altogether new force comes into play: the credit system, which in its first stages furtively creeps in as the humble assistant of accumulation, drawing into the hands of individual or associated capitalists, by invisible threads, the money resources which lie scatterd, over the surface of society, in larger or smaller amounts; but it soon becomes a new and terrible weapon in the battle of competition and is finally transformed into an enormous social mechanism of centralization of capitals" (K. I.,.p. 626).

The third major factor assuring the necessary degree of structural instability to capitalism is the State, whose principal function in this respect

is exactly that of assuring the good performance of the reserve army mechanism, the credit mechanism and thus the process of centralisation and accumulation of capital (see, e.g., K. I., ch. XXVIII and XXXI)[10].

5. *Money, credit and structural instability*

As we have seen, money and credit induce in a monetary economy a certain degree of structural instability, which is crucial to simultaneously explaining cycle and growth. All the three authors agreed on the fundamental role played by the development of monetary and financial relations in explaining the high degree of structural instability of capitalism as compared to the substantial structural stability of the economic system in all the preceding modes of production.

In Keynes this crucial role is played not so much by money and credit as quantities but by money as institutional structure. The peculiar structure of a monetary economy explains both cyclical fluctuations of marginal efficiency of capital, which are considered as the major determinant of business cycles, and long-term consequences of short-term dynamics. Keynes knew very well the role of money in the process of redistribution of income (as is witnessed, e.g., by his concept of "income inflation" best analyzed in the *Tract on Monetary Reform)* and, analogously, its crucial role in allowing the continuous change of the structure of relative prices[11], notwithstanding all the rigidities characterizing the actual capitalistic market. Unfortunately in the *General Theory* the aggregative point of view necessarily clouds these important aspects of the role played by money in fluidifying the economic structure. But an important aspect is left. Attention is focused on money as a store of wealth. A monetary economy is defined as one in which the main target of the economic process is the accumulation of wealth. This makes expectations about an uncertain future play an important role:

"The whole object of the accumulation of wealth is to produce results, or

potential results, at a comparatively distant, and sometimes at an *indefinitely* distant, date. Thus the fact our knowledge of the future is fluctuating, vague and uncertain, renders wealth a peculiarly unsuitable subject for the methods of the classical economic theory" (C.W. XIV, p. 113).

That is why a monetary economy:

"being based on so flimsy a foundation, (it) is subject to sudden and violent changes. The practice of calmness and immobility, certainty and security, suddenty breaks down. New fears and hopes will, without warning, take charge of human conduct. The forces of disillusion may suddenly impose a new conventional basis of evaluation. All these pretty, polite techniques, made for a well-panelled board room and a nicely regulated market, are liable to collapse" (C.W. XIV, p. 114-115).

These quotations, chosen from among many similar ones, should be enough to recall why and in which sense Keynes believes that a monetary economy is structurally unstable(12). Even a small disturbance, either exogenous or endogenous, affecting oversensitive and conventional expectations, is liable to generate a big qualitative change in the behaviour of the economic system.

Schumpeter, differently from Keynes, perceived the crucial role of money in producing structural change, mainly in the form of credit creation. This is, in his opinion, not only the differentia specifica of capitalism, but also and foremost the necessary condition of the process of redistribution of resources allowing innovation and thus all the implied structural changes. Credit creation gives the system the necessary structural instability:

"the essential function of credit in our sense consists in enabling the entrepreneur to withdraw the producers' goods which he needs from their previous employments, by exercising a demand for them, and thereby to force the economic system into new channels" (Schumpeter, 1934, p. 106).

We may consider structural instability as a "dispositional" concept (structural change *dunàmei*). Innovation is then the internal disturbance which has the crucial role of "actualizing" structural change. Without credit, structural change would be much slower, which is the main explanation of the pronounced dynamism of the capitalist system as compared to preceding economic systems:

"while granting credit is not essential in the normal circular flow, because in it no necessary gap exists between products and means of production ... it is certain that there is such a gap to bridge in the carrying out of new combinations. To bridge it is the function of the lender, and he fulfills it by placing purchasing power created *ad hoc* at the disposal of the entrepreneur ... Thus the gap is closed which would otherwise make development extraordinarily difficult, if not impossible in an exchange economy where private property prevails" (Schumpeter, 1934, p. 107).

In Marx, both money as institutional structure and credit creation play an important role in explaining structural change under capitalism. We cannot even understand capital if we do not start from money and analyze the process of development of monetary and financial relations:

"if we abstract from the material substance of the circulation of commodities, that is, from the exchange of the various use-values, and consider only the economic forms produced by this process of circulation we find its final result to be money: this final product of the circulation of commodities is the first form in which capital appears" (K. I., p. 146).

In the simplest monetary form of circulation, Commodity-Money-Commodity there is already *in nuce* the possibility of both crisis and structural change, i.e. of both capitalistic fluctuations and accumulation. Money spatially and temporally separates purchase and sale which is the root of the structural instability of capitalism. We cannot here follow the development of this basic contradiction which implies the development of structural instability

up to the specific form characterizing capitalism: "the historical progress and extension of exchanges develops the contrast, latent in commodities, between use-value and value" (K. I., p. 86). We would only like to observe that besides this genetic or "diachronic" point of view we may find in Marx another one which we may call "synchronic" in that it assumes as given the basic institutional structure of capitalism (but not its economic structure). In this second perspective, credit is considered fundamental in explaining structural change and in providing a crucial link between cycle and growth:

"the credit system accelerates the material development of the productive forces ... at the same time credit accelerates the violent eruptions of this contradiction "crises" and thereby the elements of disintegration of the old mode of production" (K. 3, p. 441).

We may now appreciate the analogy between i) Marx's "diachronic" point of view, which focuses on money as an institutional structure, and the Keynesian point of view (this is partially admitted by Keynes himself in private notes and correspondence); ii) between Marx's synchronic point of view, which focuses on credit as a crucial control mechanism of structural change under capitalism, and the Schumpeterian point of view (this is openly admitted by Schumpeter himself).

6. Short-period, long-period and structural instability

We utilizzed, at the beginning of this paper, the traditional distinction between short and long period to settle the order of exposition. Any perceptive reader has by now understood that this distinction cannot be conceived in the usual way with Keynes, Schumpeter and Marx. All of them would agree that we may recognize in economic reality more or less permanent forces and relations. This is why they conceive of the economic structure as a hierachical system articulated in different subsystems characterized

by different degrees of permanence, i.e. of structural instability. There is no harm in using the long-term concept for designating the more permanent relations, and short-term for designating the more structurally unstable relations, apart from the minor and easily mendable inconvenience that a dychotomy may not be enough (especially with Marx) to adequately indicize the different levels of the hierarchy. The important point is that we have thus to consider the relation between short and long period in a way radically different from the usual one.

Long-term parameters affect short-term dynamics and vice-versa. If we consider first of all Keynes, we may see that long-term expectations affect short-term equilibria as well as disequilibrium dynamics. So, for example, speculative demand for money (M_2) crucially depends on long-term expectations about "what is considered a fairly *safe* level of r", the long-term rate of interest:

"a given M_2 will not have a definite quantitative relation to a given rate of interest r; what matters is not the *absolute* level of r but the degree of its divergence from what is considered a fairly *safe* level of r" (Keynes, 1936, p. 201).

The safe level of long-term rate of interest is regulated by long-term expectations which are highly conventional:

"the rate of interest is a highly conventional, rather than a highly psychological, phenomenon for its actual value is largely governed by the prevailing view as to what its value is expected to be. *Any* level of interest which is accepted with sufficient conviction as *likely* to be durable *will* be durable; subject of course, in a changing society, to fluctuations for all kinds of reasons round to expected normal" (ibid., p. 203).

As we can see, not only long-term expectations may affect short-term variables, but the influence may be so strong as to auto-realize themselves as self-fulfilling prophecies. Analogously short-term values affect in their

turn long-term parameters (and thus also long-term equilibria). So, for example, a reduction in money-wages associated with unemployment would be likely to affect the functional structure of the system, shifting the three "psychological" schedules: propensity to consume, liquidity preference, marginal efficiency of capital. Generally speaking, according to Keynes, short-term shocks could shift long-terms expectations:

"a conventional valuation which is established as the outcome of the mass psychology of a large number of ignorant individuals is liable to change violently as the result of a sudden fluctuation of opinion due to factors which do not really make much difference to the prospective yield since there will be no strong roots of conviction to hold it steady" (ibid., p. 154).

Turning now to the point of view of Schumpeter, we way observe -first of all- that in his opinion the distinction between short and long period is unsatisfactory (see e.g. Schumpeter, 1939, p. 45). Still he doesn't altogether rule out the use of this distinction but only a use implying independent layers of reality. First of all, he often stresses that equilibrium, even long-run equilibrium, depends on short-term disequilibrium dynamics:

"ultimate equilibrium, even if reached and even if nothing has occurred to change the situation, will in general depend on the path by which it is reached, i.e. on the whole series of transactions that are usually carried out at varying prices as the situation unfolds" (Schumpeter, 1939, p. 49).

Moreover we could add that short-term influences on entrepreneurs' behaviour will probably exert a long-term influence on the structure of capital stock because of the induced change in the pace and direction of innovation. Finally we should remenber that Schumpeter is fully aware that long-term structural characteristics of capitalistic order (for instance the credit creation process) affect the functioning of a capitalistic system (for instance the process of innovation) and, inside the capitalistic system, the long-term equilibrium affects short-term processes of adjustment, mainly in the depression phase of business cycle.

Turning our attention to Marx, we may observe that short-term disequilibrium dynamics, after a certain threshold, induces structural change. So, for example, a fall in the rate of profit below what capitalists believe to be acceptable, not only "breeds over-production, speculation, crises, and surplus-capital alongside surplus-population" (K. 3., p. 242), but also induces counteracting influences affecting economic structure (ch. XIV of K. 3.). At the same time, the long-term structure determines the rules of the game for short-term dynamics. So, for example, the "law of value", as is well-known, works in different ways in different phases of capitalism, not to mention different modes of production.

We could now ask ourselves whether our three authors' points of view may be reciprocally co-ordinated. Keynes focused on the structural instability of financial circulation in a monetary economy, Schumpeter on the structural instability of production and circulation in each of these phases. This does not imply that the broader scope of Schumpeterian analysis makes the contribution of Keynes superfluous nor that the even broader scope of Marxian analysis gets rid of "bourgeois economics", particularly in the Keynesian and Schumpeterian version. Many analytical details provided by Keynes on financial circulation cannot be found either in Schumpeter or in Marx and many analytical details provided by Schumpeter on production processes cannot be found either in Keynes or in Marx. Their contributions could be then coordinated and developed according to the preceding lines.

7. Summary and conclusions

We have tried to show in this paper that instability of capitalism as analyzed by Keynes, Schumpeter, and Marx cannot be properly understood in terms of dynamic instability only. On the contrary, the crucial instability concept worked out by these authors has to be properly modelled in terms

of structural instability.

A certain degree of structural instability, however spatially, temporally and analytically circumscribed, is relevant because sooner or later it will leave irreversible[13] structural traces in the economic system. This is also the way to vindicate an important role for dynamic instability, as a production mechanism of disturbances inducing discontinuous structural changes. This approach may put us in a better position for analyzing structural change in economics. The difficult but crucial problem of explaining structural change is articulated in two subproblems which appear more tractable: a) the explanation of the set of forces giving the economic system its peculiar degree of structural instability (e.g. peculiar financial relations); b) the explanation of the characteristics of the relevant disturbances actually inducing a certain well-defined structural change.

The decomposition of a difficult problem into difficult simpler subproblems is a very well known principle of problem-solving. We believe that, in due time, it will help us to come to grips with the intractable problem of structural change in economic systems. For the time being, we have tried to relate this promising approach to the powerful insights of three giants of economic thought in the hope of seeing better and farther from their shoulders.

This paper was not meant to clarify the *differentiae specificae* which, as is well known, divide and contrast the theories of the authors here considered. Our aim was only that of picking out a few common ideas which we may try to summarize in the following way:

a) to understand properly the instability of a capitalist economy a crucial concept of instability is that of structural instability;

b) a system is defined as structurally unstable if it is liable to undergo a discontinuous structural change when disturbed;

c) the disturbances inducing structural change may be endogenous or exogenous to the economic system. Our three authors considered the role of

external disturbances as trivial for economic theory (not of course for economic history). That is why they limited themselves, in their theoretical contributions, to analysing the relation between endogenous disturbances and structural change of economic systems;

d) the attribute of structural instability is conferred on the economic system mainly by financial relations (money and credit);

e) capitalistic fluctuations are intimately related not only to the dynamic instability of the economic system but also to its structural instability;

f) internal disturbances, which are cause and effect of fluctuations, impinging on a structurally unstable system, induce a structural change and thus produce development and growth;

g) as a consequence of the preceding points we cannot conceive fluctuations as independent of growth and viceversa, or short-term fluctations as independent of long-term and viceversa.

APPENDIX

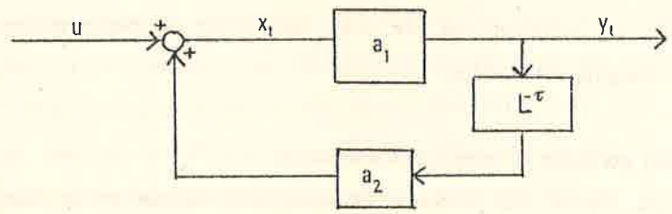
Structural instability in linear discrete-time dynamical systems

This appendix aims at giving a more tangible perception of the meaning of structural instability. It may also be considered as a very preliminary step towards working out a family of operational concepts suitable for the analysis of structural instability in economic processes. It thus goes in the direction of building up a bridge between the topological concept of structural (in)stability (which is the most rigorous and comprehensive concept of structural (in)stability) and current modelling practice in economics.

1. Background

Let us describe an economic system in terms of block diagrams (for the sake of simplicity we will only consider only discrete-time linear systems here).

The simplest case of dynamic system exhibiting both endogenous and exogenous dynamics, is an elementary feed-back system which may be represented in canonical form as in fig.1, where $\bar{u}$ is a constant input, Y_t the output, $L^{-\tau}$ the lag operator, a_1 and a_2 multiplicative coefficients.



As is well-known the equilibrium value of the output variable is given by

$$(1) \qquad y^* = \frac{a_1}{1 - a_1 a_2 L^{-\tau}} \bar{u}$$

and the disequilibrium dynamics (assuming for simplicity $\tau=1$) by

$$(2) \qquad \bar{y}_t = (a_1\ a_2)^t\ \bar{y}_0$$

where y_t is the deviation from equilibrium at time t.

We may define the flow structure (or connective structure) as the structure of oriented arrows connecting the variables of the system. It may be rigorously expressed by a "connective matrix" or by a digraph, i.e. directed graph (see Siljak, 1978). We may define the set of coefficients written inside the blocks as the set of "functional coefficients" since they express, in the linear case, the functional relations among the endogenous variables. We may thus define as "functional structure" of the system the matrix of functional coefficients written in the order specified by the connective structure. (The graph drawn in Fig.1 shows that we may, in principle, change one or more functional coefficients without changing the connective structure or viceversa, although often a structural change affects both).

In principle, a change in the functional coefficients and/or in the connective structure of the system affects its dynamic behaviour. This is obvious for functional coefficients, since they appear with a crucial role in both (1) and (2). However, not only the value of these coefficients, but also their connective position is important as we may easily verify changing their position without changing their value.

2. *Three operational concepts of structural instability*

We may now define the concept of structural change *prima facie*. A system undergoes a structural change *prima facie* whenever its functional structure is modified. We propose now for our purposes to define as a "genuine" structural change (or structural change *tout court*) any structural change *prima facie* having the effect of modifying the dynamic behaviour of the system (i.e. equilibrium and/or disequilibrium properties). This is generally true of structural change *prima facie*, as we have seen in the preceding paragraph, but it is not necessarily true. Different functional structures may have the same reduced form and thus the same dynamic behaviour.

We are now in a positon to define structural instability as a discontinuous (or qualitative) structural change induced by a small perturbation. We have still to clarify the notions of small perturbation and of discontinuous structural change. A small perturbation may be understood as "arbitrarily small" as in most topological definitions (see the appendix to Vercelli, 1984). But this definition is too demanding for economics. The main problem of many economic analyses is to know how the economic system will react to perturbations of finite dimension (e.g. to alternative economic policies). Small, in this sense, is a relative concept. It is natural for our purposes to specify the meaning of small perturbation in relation to the size of the induced discontinuous structural change. But, what is a discontinuous structural change? We may give two different kinds of definition. According to a first "strong" version, we have a discontinuous structural change whenever:

a) the equilibrium properties (not only the values) are altered. This happens whenever we observe a switch from unicity to multiplicity of equilibria, or from determinateness to undeterminateness, or from one kind of attractor to another, etc.;
b) the disequilibrium properties are altered in their sign (not only in the speed of convergence or divergence to or from an equilibrium point).

This meaning is of course quite demanding. We may conceive of a weaker version considering as a discontinuous change any quantitative jump exceeding a certain preassigned standard, even without any of the qualitative transformations aforementioned.

We may now combine the two couples of meanings for small perturbation and discontinuous structural change and define three notions of structural instability which are of interest for economics:

i) strong concept of perturbation-strong concept of discontinuous structural

change : (strong) structural instability;

ii) weak concept of small perturbation-strong concept of discontinuous structural change: -structural instability;

iii) weak (or strong) concept of perturbation-weak concept of discontinuous structural change: weak structural instability.

Only the first meaning is traditionally associated with structural instability by topological literature (see Vercelli, 1984, appendix), but we believe that the other two meanings may also be useful for economic analysis. We will not try to develop here a formal analysis of these three concepts and their interrelations. We will limit ourselves to consider a very simple example. Let us take the usual version of the dynamic multiplier. We may visualize such an elementary model in our fig.1 specifying the variables and parameters in the following way: $\bar{u} = \bar{I}$, autonomous investment; $x_t = E_t$, aggregate expenditure; $y_t = Y_t$ aggregate income; $\tau = 1$; $a_1 = 1$; $a_2 = c$, marginal propensity to consume.

According to the first definition (strong structural instability) the system would be structurally unstable only for $c = 1$ and not for values even slightly different. In that case and only in that case, an arbitrarily small perturbation impinging on the marginal propensity to consume would alter the qualitative dynamic behaviour of the system in the strong sense. In fact, with c exactly equal to one (and in absence of autonomous expenditure), the system would be in neutral equilibrium (which would then be undetermined); with $c<1$, the Keynesian case in the *General Theory*, the system would have only one stable equilibrium; with $c>1$, the system would have only one unstable equilibrium (These three cases may be easily visualized with the well-known crossdiagrams).

Let us assume now that $c<1$, but with a value very close to one (say 0,95). The system is not structurally unstable for the first definition, although it would be considered such in ordinary language on many practial occurrences. As a matter of fact, a very small perturbation, say $\Delta c = +0{,}06$, would

be enough to induce a discontinuous structural change in the strong sense. We may resort to the second meaning of structural instability here proposed: the system may be considered -structurally unstable for $\varepsilon \gtrsim 0.05$.

Let us assume at last that $c<1$, with a value again very close to one. Any finite perturbation, even very small, in the marginal propensity to consume will induce a much bigger (in percentage) change in income and expediture which may be considered discontinuous in the weak sense of the word. We may legitimately wonder whether we should apply to this kind of behaviour a concept of structural instability, albeit in the weak version, or some other concept. Still, there are good reasons to underline with this terminology a certain kinship with (strong) structural instability.

First of all, we believe that, in ordinary language, we would call a system exhibiting such behaviour unstable, clearly not meaning by that dynamical instability. Moreover, this sort of behaviour is typical for values of the parameters close to those generating (strong) structural instability. Anyway, this is mainly a terminological problem which does not affect the substance of the argument. We should on the contrary warn the reader that the impression of "queerness" conveyed by (strong) structural instability in our example fully depends on the dimension 2 of this oversimplified model. Only in this case is structural stability generic and structural instability "queer". It has been proved that for systems of higher dimension structural stability is not generic and structural instability very "likely", the more so the higher the dimension of the system (see Vercelli, 1984, appendix). We conclude this appendix observing that in the text of this paper we have not clarified which kind of structural instability we were speaking about. We have generically considered discontinuous structural changes induced by perturbations, without specifying either the size and kind of perturbation and structural change. The next step of the research program here briefly outlined should consist in working out well-specified analytical models clarifying for each author and/or problem considered which kind of structural instability is involved and how.

Notes

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(1) See Cugno F., Montrucchio L. (1982).

(2) From the criticism of Say's law, appearing at the very outset of *General Theory*, to the criticism of the received doctrine of financial stability and of the stabilizing role of price and wage change, at the end of the theoretical part of the book, the instability of a monetary economy may be considered as one of the principal *leit-motiv*, if not actually the principal, of Keynesian theory.

(3) Mainly, but not only, in Chapter 18; which is Keynes' own summary of the core of this theory.

(4) "There may be a range within which instability does in fact prevail. But, if so, it is probably a narrow one" (Keynes, 1936, p.252).

(5) See Keynes, 1956, Chapter XIX, par.2.

(6) This quotation is the final statement of a very clear and articulated analysis of the relation between short-period and long-period contained in a draft dated 14 November 1932. Keynes clearly kept firmly to this opinion, since we may find similar statements in the *General Theory*, particularly in the criticism of Ricardian theory of interest contained in the appendix to Chapter 14:

"Ricardo and his successors overlook the fact that even in the long period the volume of employment is not necessarily full but is capable of varying, and that to every banking policy there corresponds a different long-period equilibrium corresponding to different conceivable interest policies on the part of the monetary authority" (1936, p.191).

(7) See Keynes, 1936, Chapter XIX, par. 2.

(8) It is interesting to recall that Keynes mentions in the *Treatise* the salient features of Schumpeter's theory of cyclical growth, with the following comment: "Professor Schumpeter's explanation of the major movements may be unreservedly accepted" (Keynes, 1930, II, p. 95-96).

(9) Here we find an interesting difference from Schumpeter's thought. According to the Austrian economist, the internal disturbances not only induce structural change but also destroy the equilibrium so that dynamic instability has no role to play in the phase of "creative destruction".

(10) As is well-known, Marx never accomplished his original outline of *Das Kapital*, worked out in 1857, which included a 4th book on the role of the state in Capitalism. That is why the main references to the economic role of the state may be found in the first book in relation to primitive accumulation:

"The bourgeoisie, at its rise, wants and uses the power of the state to "regul-

ate" wages, i.e. to force them within the limits suitable for surplus-value making, to lengthen the working-day and to keep the labourer himself in the normal degree of dependance. This is an essential element of the so-called primitive accumulation" (K. I., 737). In addition, "The public debt becomes one of the most powerful levers of primitive accumulation ... the national debt has given rise to joint-stock companies, to dealing in negotiable effects of all kinds, and to agiotage, in a word to stock-exchange gambling and the modern bankocracy" (K. I., 755).

(11) "The fact that monetary changes do not affect all prices in the same way, in the same degree, or at the same time, is what makes them significant. It is the divergences between the movements of different price-levels which are at once the test and the measure of the social disturbances which are occurring" (Keynes, 1930, p. 94).

(12) In particular, a pure credit economy "would possess an inherent instability; for any event which tended to influence the behaviour of the majority of the banks in the same directions whether backwards of forwards, would meet with no resistence and would be capable of setting up a violent movement of the whole system ... Moreover, where the condictions for a "closed" system are satisfied, as in the case of a country having an inconvertible paper currency or in the case of the world as a whole, the tendency to instability by reason of sympathetic movement is a characteristic of the utmost practical importance" (Keynes, 1930, I, p. 27).

(13) One of the deep reasons of irreversibility of this sort of structural change, may be understood in the following terms. Structural change in economics is often the result of (structural) stabilization processes which are, in principle, irreversible as is clarified by modern topological literature: "the irreversibility of stabilization processes, may appear slightly paradoxical.

It depends on the fact that the property of stability is an open one. Thus, whenever through the "explosion of a critical point or through the separation of critical values of f, we stabilize f in f' by infinitesimal deformation, we cannot come back from f' to f unless by finite deformations. By infinitesimal deformations we may only, as soon as we reach f', get f' again, because f' is stable" (Petitot, 1979).

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