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LEIBNIZ AND THE DEVELOPMENT OF ECONOMIC RATIONALITY

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INTRODUCTION: Economic rationality and Western civilization

One of the aims in the Trends in Western Civilization Program is to identify and analyze theories of the "central processes" in Western history. In the tradition of Western self-images the development of a peculiar form of liberty and rationality is conventionally taken to be the distinguishing feature which characterizes Western civilization as compared with other civilizations.

Whether these images are "true" or helpful means of understanding Western history, we shall not discuss here; the important point is only that they have been produced and used in the West since the ancient Greeks made the comparison between "Europeans" and "Asiatics". But this makes it legitimate to investigate the reality of these images, their historical conditions and changing content.

The present paper by Jon ELSTER deals with the economic dimension of Western rationality and with a particular period and a particular writer in view. Within the context of the transition from mercantilism to industrial capitalism, LEIBNIZ's thought represents a decisive step towards the economic rationality which is part of the capitalist system. Thus ELSTER's short account naturally elucidates both the character of capitalism and the more specific elements of formal and instrumental rationality inherent in capitalism.

As for formal rationality, ELSTER observes that WEBER and LEIBNIZ alike took double book-keeping and rational bureaucracy based on written, abstract law as their paradigms, - because both double book-keeping and Western bureaucracy embodied the principle of impersonal, mechanical operations in human affairs, making possible the quantifiability, calculability, and hence previsibility (planning) of phenomena which in other societies were less previsible.

A case in point is the tradition of Western law. What has it concretely to do with the rise of capitalist rationality, and how typically "Western" is it really? Since the question why capitalism developed just in the West often revolves around historical comparisons between China and the West, it is interesting to note that ELSTER, in his paragraph on the abstract and general character of Western law (pp. 7-8) dismisses Joseph NEEDHAM's radical suggestion that LEIBNIZ is a European representative of the main ideas in Chinese philosophy.

From the perspective of the Trends in Western Civilization Program, ELSTER's analysis of economic rationality highlights at least two fields of further study:

1. The empirical history of book-keeping and bureaucracy in the West, the mechanization of the production sector and the rise of the mechanical-rational universe by the age of LEIBNIZ.

2. Comparisons of Western and non-Western, especially Chinese, forms of rationality in history. How peculiar is Western rationality, and what are its long-term historical roots? The study of Western rationality is more than a purely academic concern since this mode of rationality directly affects our own lives as well as those of the Third-World victims of imperialism. In future papers, therefore, we shall contribute to the critique of modern Western rationality and the palpable workings of its economic and cultural systems. This will be done on the basis of HORKHEIMER/ADORNO, Dialektik der Aufklärung and other critical works.

Substantiating details and references to the interpretation in the present paper are found in JON ELSTER, Leibniz et la Formation de l'Esprit Capitaliste (Paris: Aubier-Montaigne, September 1975).

Oslo, July 1975

Erik Rudeng

Jon Elster: LEIBNIZ AND THE DEVELOPMENT OF ECONOMIC RATIONALITY [1)]

1. I would like to give a socio-economic interpretation of Leibniz' metaphysical, scientific and theological writings as well as an exposition of his economic and sociological writings. I will concentrate upon one particular field of interest: Leibniz' importance as a spokesman and interpreter for the emerging capitalist economy. This implies a relative neglect of the mercantilist strain in his thought, as well as a lack of stress upon his contributions to pure economics and sociology. Finally I shall adopt a rather naive epistemological attitude, in that I shall not be much concerned with the thorny questions of the sociology of knowledge. I believe I have some answers to these questions, but this would not seem to be the main interest of this group.

2. It may be a slight surprise to some of you to hear that Leibniz was actively engaged in technological, economic and political matters from the age of thirty, beginning roughly with his stay in Paris 1672-1676, to his death at seventy. His technological activities mainly deal with the problem of water-hauling in the mines. During the seven most formative years of his life, when his metaphysics and physics took their definitive shape, he spent about 165 weeks out of 365 in the mountains of the Harz, belonging to the Duke of Brunschwick-Hanover. It is possible to show in detail how the most abstract ideas of his physics arise out of the problems involved in harnessing and conserving the energy of the wind. Just as important is the economic setting of these engineering activities. Leibniz was himself an entrepreneur engaged with his own capital, as well as being responsible towards the Duke and the mines which contributed two thirds of the total capital. His various proposals and justifications show up very

1) Paper presented to the Trends in Western Civilization seminar, May 21, 1975.

clearly his acute awareness of the economics of technical change. They also exhibit his concern with the rational book-keeping in which he saw one of the two great paradigms for his mechanical reasoning, the other being the abstract arguments of the law. In addition he also proposed to his various benefactors a series of income-generating schemes, most of which had the unhappy characteristic of trying to have your cake and eat it. In his concrete proposals Leibniz was very much a man of his mercantilist environment: obsessed with security rather than wealth, seeing the international trade as a zero-sum game, giving preference to short-term goals over long-term ones, confusing capital with money, giving excessive importance to employment, stating that wars could be kept up indefinitely as long as the money did not leave the country, and so on.

3. The correspondence and the pamphlets on matters of immediate practical interest form what I call the first level of Leibniz' socip-economic writings. The second level consists of his more disinterested writings on general sociological and economic matters. These writings may somewhat artificially be divided into two groups, concerned with normative and analytical matters respectively. Leibniz was a pioneer in welfare economics. His concept of innocent utility is coextensional with the notion of Pareto-optimality. His schemes of compensation have much in common with those of Kaldor and Scitivsky. His reflections upon the conditions for optimal technological utilization and development are of a distinct Schumpeterian cast. It is true that the context of most of these writings is juridical rather than economic, but then Leibniz was concerned with de lege ferenda and not with de lege lata. On the other hand Leibniz forged some remarkable analytical tools, the most important being the distinction between additive and multiplicative notions in the study of society. He argued for example that one nation's power relative

to another nation should be conceptualized as the product of the number of soldiers and a declining function of the distance to the border, this product being taken in the continuous sense, that is as an integral. He also argued that the production function of a firm should be seen as a multiplicative one: p=axy, where a is a constant and x,y are the factors of production. From this he argued that for efficiency all production should be concentrated in one firm. An analogous argument for the utility function brought him to the conclusion that because of rising marginal utility all consumption should be concentrated in one consumer. In order to temper this unpalatable conclusion he then introduced the notion of lexicographic preferences correponding to a hierarchy of wants. Unhappily this expedient is incompatible with his fundamental utility-maximizing approach, as lexicographic preferences are the standard example of preferences that cannot be represented by a utility function.

4. The third level, on which I shall concentrate here, is found in the socio-economic interpretation of Leibniz' writings on metaphysics, epistemology, theology, physics, biology and the other sciences. As a concession to the epistemologist it should be stated here that this interpretation is not arbitrarily imposed upon the text, as is so often the case with Marxist interpretations of philosophy and science. The socio-economic interpretation is found <u>in</u> the text, through the numerous economic analogies that Leibniz constantly invoke in order to explain the structure of his argument. When examining the three levels that I have distinguished, the following paradox emerges: the economic ideas found in Leibniz' economic writings are more backwards and confused than the economic content of his metaphysics. Only when the apparent subject is a non-economic one does Leibniz grasp the logic of the emergent capitalist economy. The analogies of the philosophical and scientific writings give an extremely clearcut picture of the

capitalist rationality, both at the individual and at the systemic level. God is the supreme businessman, maximizing a profit over the scarce resources of the universe. The progression of the universe takes the specifically capitalist form of growth mediated by crises and regressions.

5. Rather than trying to define capitalism, I shall enumerate a certain number of features that empirically have been present in the Western economies of the last three hundres years. Among these features some may be taken as defining characteristics, others as properties that are causally implied by the defining ones, and still others as accidental properties that might have been absent. I shall not try to sort them out in this was, but treat them all on a par. The following characteristics may then be singled out for attention.

I. Formal rationality, in Max Weber's sense. This means, roughly, quantifiability, calculability, previsibility, as embodied in the double book-keeping system and the rational bureaucracy.

II. Instrumental rationality, still in Weber's sense. In my interpretation this means action according to the goal of maximizing a difference, viz. the difference between the end and the means. In value-rational actions the end and the means are chosen in two successive stages, whereas the instrumental rationality implies a single choice that fixes both the end and the means simultaneously. Thus capitalist production has as a maximand net production or profit, whereas many pre-capitalist societies have had gross production as the maximand, or at any rate as an end that is determined independently of costs.

III. Wage-labour. For our purposes the important fact about wage-labour is the anonymous and impersonal character of the domination-exploitation that it embodies. The external force and violence of pre-capitalist dependance is less efficient than

the internalized discipline of the capitalist labour force. From Marx and Weber to Fromm and Thompson this has been a much stressed aspect of capitalism. It may be noted in passing, however, that it is incompatible with the view that sees the Hegelian master-slave dialectic as the paradigm for capitalist class relations, as this is indeed a highly personalized form of dependence and exploitation.

IV. Reinvestment of the surplus. This is sometimes, as in Marx' Grundrisse, taken as a defining feature of capitalism; elsewhere, as in Weber, it is hardly stressed at all, unless(pace Keynes) one sees savings and investment as synonymous. It should be stressed that investment out of profits is very different from the speculative investments out of capital that have always been found since Classical Antiquity. We are dealing here with investment as a regular , steady-state process, and not with the irregular investments made in hope of windfall profits.

V. Technological change. In an economy with a generalized reinvestment this follows at once, for in the long run reinvestment of profits cannot take place on an unchanged technological basis. Again it should be stressed that capitalist technology is a very different phenomenon from pre-capitalist technology: the latter may be equally sophisticated, but it consumes capital rather than forming capital.

VI. A firm link between unequal income distribution and maximization of steady-state average income. In most economic models of capitalism, as well as in most studies of the Industrial Revolution, it is stressed that economic growth cannot take off unless the income distribution is so skewed as to make some people rich enough to save and invest. The idea is already found, if less clearly, in Mandeville's Fable of the Bees.

VII. A firm link between short-term suboptimality and long-term optimality. This is the temporal version of the preceding

trade-off. It is, of course, the Scumpeterian idea par excellence: lack of efficiency of the capitalist system can be justified by pointing to the long-run creativity that is set free by this very inefficiency. The patent system as well as the functions of the entrepreneur are well-known cases. More trivially all neoclassical models of economic growth have an optimal rate of savings that maximizes steady-state consumption, even if in any given year consumption would have been even greater had no savings taken place.

VIII. A firm link between economic growth and periodical crises. Again this is a Schumpeterian view, also found in Kaldor: the very entrepreneurial optimism that causes economic growth in the long run, also makes for large cyclical fluctuations in the shorrt run. Thus trend and cycle are not simply superimposed,but causally correlated.

It is my contention that all of these features are found in Leibniz' writings. In the exposition below I deliberately give an excessively coherent interpretation, but some of the relevant ambiguities may be noted here. In the first place there is the fundamental hesitation between the mercantilist and the capitalist world view. This difference pertains to almost all the features mentioned, as will be recurrently noted below. In the second place the rationality of Leibniz somehow seems too rational, in that he does not at all take into account the costs of information and of development. In the third place the reinvestment aspect in Leibniz is not as systematic as I have here made it out.

6. Formal rationality. Weber and Leibniz alike take as their paradigms double book-keeping and the rational bureaucracy. For Leibniz the ultimate end of all philosophy is to develop a

"Begriffsschrift", a conceptual language that will eliminate all ambiguity and all appeal to intuition; that will be purely mechanical in the sense of being embodied in a calculating machine, a field where Leibniz did revolutionary work and where he often cites the practical as well as the philosophical applications. In Leibniz' famous saying: "Cum Deus calculat, fit mundus", when God had made his calculations, he created the world. This inherently rational character of the universe guarantees the possibility of a rational and conceptual language, similar to the book-keeping systems. It should be mentioned here that Leibniz, in contradistinction to Descartes, also wants to quantify the uncertain and the probable. A famous text mentions epistemology, the theory of games and the theory of portfolio selection in the same breath.

Leibniz stresses the rationality of law in two different senses. In the first place he sees the abstract and general character of the laws as a paradigm for that blind reasoning which always was his ideal, in contradistinction to the intuitive judgment of the individual arbitrator. In the second place he anticipates Max Weber in attaching great importance to the legal framework as a constant basis for economic actions. For long-run economic growth the constancy and foreseeability of the legal decisions are more important than the inherent justice of any single judgment. If laws are known and judgments can be foreseen, then the individual may protect himself against injustice by taking care not to bring himself into situations where unjust decisions can be expected. I believe that this stress upon the abstract, impersonal and purely formal character of the law invalidates the interpretation of Joseph Needham, who has argued that Leibniz is a European representative of the main ideas in Chinese philosophy. With the exception of the

Legalist school, which does indeed have affinities with Leibniz, but is not considered typical by Needham, all main currents of Chinese thought seem to have proposed exactly the intuitive and concrete system of law that Leibniz abhors.

V. Instrumental rationality. This is perhaps the most profound point of contact between Leibniz' metaphysics and the emerging capitalist economy. The issue is the divine rationality in the choice between the possible worlds. Roughly four different positions may be distinguished in the course of the 17th century. At one extreme is the position of Descartes, who saw God as his own criterion of rationality and optimality; who stated that the present world is the best of all possible worlds because it has been created by God, rather than conversely; who held that even the laws of logic are created by God and might have been different in another universe; who denies all possibility of a comparison ex ante between the possible worlds, except on criteria that are themselves ex post. The second position is found in most of scholastic philosophy: it states that the worlds are comparable ex ante, but that there is no world that represents a maximum of perfection, so that God might have created an even more perfect world than the existing one. This is reminiscent of (or anticipatory of) the models of economic growth over infinite time, where no consumption sequence is the best. The third position is found in the polemic that opposed the Jansenist Antoine Arnauld to the Oratorian Nicolas Malebranche: Arnauld held that God first chooses the world(s) that realize the maximum of production and then, if there are several worlds that are equally and maximally good, chooses that one which realizes the maximum with a minimum of cost, which means roughly minimum of complexity. Malebranche held - simultaneously

with and independently of Leibniz - the fourth position, according to which God realizes the world which encompasses the maximal net perfection, net, that is, of the costs that are implied in the complexity of the laws of nature. This means that Arnauld attributed value-rationality to God, whereas Malebranche saw him as the incarnation of instrumental rationality. The constraints that according to Malebranche limits the perfection of the world to a maximum is, to simplify a rather tortuous argument, the limited quantity of Grace available through Jesus Christ.

The position of Leibniz on this point is very complex, even if in general accordance with the ideas of Malebranche. There are so to speak two distinct strands in Leibniz' argument. In the first place there is the moral economy of the universe that conceives evil and suffering as the costs of production for the good. Leibniz everywhere tells us that the evils could not be eliminated without this entailing a still greater loss of perfection, so that in the present world, by implication, the marginal productivity of evil equals the cost of evil. In the second place there is the physical economy of the universe that limits the perfection to a maximum, because of the constraints that are imposed upon the divine choice by the finiteness of space and time. By finiteness is meant here finiteness of the number of dimensions rather than finiteness in each dimension. Leibniz' famous philosophy of time is indeed developed in parallell with his economics views, so that during the 1670's it can be observed in textual detail how the "economic" view of time as a scarce resource("time is money") is at the origin of the relational philosophy of time.

The problem is that the two lines of thought just sketched are not very well integrated. In the evil-as-a-cost-of-production approach there is no explanation given for the implicit assumption of diminishing marginal productivity, whereas in the scaree-resources approach nothing is said about costs of production at all. Formally it might be possible, however, to synthetize the two approaches by the following simple model: imagine a society where the goal of production was to maximize gross production subject to resource constraints whereas the goal of consumption was to maximize net utility, counting as negative utility the sufferings implied by the optimal distribution of the maximal volume of production.

9. Wage-labour. The point at issue is the form of dependence. "A slave needs a master, but a wage-labourer must learn to master himself", said Marx. This point is developed by Leibniz in his theory of preestablished harmony, as a model for which he often uses the relation between employer and workers or the relation between the king and his subjects. The most important passages are probably to be found in the polemics against Clarke, where the two philosophers discuss the nature of the divine power, and by analogy the royal power. Clarke stated that a king who never needed actually to exert his power, would be a nominal king only, whereas Leibniz on the other hand saw the use of power as consumption of power. In another text he discusses the mind-body relationship and likens it to the relation between a master and a servant. The good servant anticipates the orders of the master, so that the master never has to give any orders: he is thus powerless in appearance, but supremely powerful in reality. Descartes saw the body as a slave that had to be curbed and repressed by the mind, but Leibniz

conceives it as a worker who by preestablished harmony has internalized the norms of the master. Long before Durkheim Leibniz came up with his answer to the problem of social cohesion: individuals are neither completely identical, nor completely different in the sense of having interests distributed at random; thet are different in a harmonious way, each monad representing the whole from its point of view.

Needless to say, Leibniz is nothing as clearsighted when discussing the actual state of the workers in 17th Century Germany. In his politico-economic discussions he seems bogged down in the traditional way of thought, that sees no alternative between outright slavery and artisanal independence. The specific nature of wage labour, being a union of formal independence with material dependence, seems to have escaped his attention.

10. Reinvestment. As mentioned above, Leibniz was himself an investor. He used his own capital in the research and development needed for his successive wind mills for water-hauling, laying down in advance the annual renumeration that he was to receive if the invention worked, which it never did. It cannot be said, however, that he really embodied the ethic of perpetual reinvestment. When proposing some profit-raising scheme to one of his benefactors, he usually adds that the profits should be used for the creation of academies and not simply for the creation of still more profits. The psychological writings of Leibniz, on the other hand, do express most eloquently the idea of perpetual increment. Pleasure, he stated, is never attained in the possession of some constant degree, but in the perpetual progression towards higher degrees. In a more general manner we find in Leibniz' writings a "chain analogy" between the following three concepts: the

accumulation of capital, the acceleration of bodies and the progression of pleasures. Many of the details of Leibniz' physics may be explained on the analogy with the accumulation of capital, to which we have to add that other details still must be explained on the analogy with the circulation of money.

This important point requires some elaboration. Leibniz justly criticized the laws of conservation of Descartes and substituted for them what we should call today the law of conservation of energy. He also in many texts explicitly compares capital and energy(which he called "living force"). This analogy immediately fits into a zero-sum vision of the economy, where the profit of one entrepreneur must be made at the expense of another's loss. On the other hand Leibniz was aware, much more so than Descartes, but certainly less than Newton, of the importance of uniformly accelerated movement. In acceleration energy seems to be created, just as in a capitalist economy surplus value is created. Marx long ago explained that you cannot make surplus value out of circulating capital, but Leibniz tried hard to make accelerated movements out of the laws of conservation. This is indeed possible but only on the condition that potential energy is accepted, which Leibniz never did. Leibniz had to explain the energy gained by some bodies as a result of other bodies losing actual(which for him meant kinetic) energy, a task that is just as hopeless as the task of explaining profits within the sphere of circulation. On one hand Leibniz was acutely aware of the importance of acceleration-accumulation, but on the other hand his theoretical principles did not permit him to explain it adequately. We shall return to his hesitation before the question of growth.

11. Technological change. It has been usual, not least among Marxist historians of science, to find in Descartes the first

spokesman for the capitalist age in science and philosophy. Marx himself refers to the theory of animal-machines as "the point of view of the age of manufacture".I think, however, that it can be demonstrated that the Cartesian machine - an automatic fountain acting on feedback principles - is a very singular and very specific piece of technology, quite obviously posterior in conception to the metaphysical ideas it was intended to illustrate. In addition it is obviously the technology of luxury consumption rather than the technology of production to which Descartes is here referring. Just as Descartes had an eye for technology, but not for the specifically capitalist form of technology, he grasped the notion of investment, but not the capitalist form of perpetual reinvestment. There exists a very amusing text where Descartes with magnificent rigour explains that you should repay with interest the man who has borrowed money from you and by doing this prevented you from investing them in a business that turned out to give a loss.

In Descartes' writings the notions of technology and of investment are kept in separate compartments, but in Leibniz' work they are integrated into the specifically capitalist notion of a productive investment. I shall not here enter into the details of Leibniz' theory and practice in the domain of inventions, except to note the following features. In the first place he foresaw the day when the making of inventions would be just as routinized as the using of inventions. By reducing machines to geometry and geometry to conceptual language, it will be possible, he thought, for any given effect to find a machine that will produce it, in the same mechanical manner that for any given theorem one could find a proof that would produce it. In the second place he attached much importance to the material aspects of inventions, and was indeed

one of the founders of the study of the resistance of solids. In one of his texts on the subject he refers to the implicit or hidden theory of the craftsmen which is just as important as the formalized theory found in books. In the third place it should be added that his powerful mind in some ways did him a disservice, for when confronted with a practical problem he was never satisfied with a stop-gap solution, but always sought the most general solution that could have the most numerous applications elsewhere. As the general solution added practical problems of it own, the process of invention became for him an infinite sequence similar to the decimal expansion of irrational numbers that was for him the paradigm of empirical knowledge. In the fourth place mention should be made of his discussion of labour-saving inventions, where he concludes that the workers' fears are groundless because new employment will be created for them elsewhere. This is a piece of vulgar optimism that contrasts curiously with the pure Leibnizian approach of Ricardo, who accepts the possibility of a temporary loss of employment through the use of machinery but justifies it by an appeal to the long-term advantages.

12. Inequality. Leibniz' Theodicy is, of course, shot through with statements that justify the moral, physical and metaphysical imperfections found in the universe. Mostly he is content with metaphorical expressions, as when he reminds us that shadows are necessary in any picture, that dissonance is required for consonance, that repetition diminishes perfection, that two odd numbers add up to an even number and so on. In a few texts, however, he tries to justify social inequality, not with arguments similar to the neoclassical case for inequality as a prerequisite for savings, nor with sociological arguments of the Davis-Moore kind, but

mostly with arguments that purport to show a conflict between formal rationality and equity. The liberty and stability of contracts requires the institute of property, even if this may seem unjust in many particular cases. Remove inequality, and the greater evil of inefficiency is set in its place. It should be added, however, that in many texts Leibniz shares the mercantilist obsession with short-term advantages, to the point of seeking a legal justification for compelling an agent to make use of my services if we both can profit from them. Once again we see that the pure logic of capitalism is better expressed in the metaphysical writings than in the texts that deal explicitly with economic matters.

13. Suboptimality and growth. Leibniz never reached a firm conclusion on the question whether there is in the universe a constant degree of perfection or on the contrary a variable degree of perfection. In the texts where he seems to choose the second position, he never is able to say for sure whether the variation takes the form of constant progression or rather the form of an all-over progression interrupted(and mediated) by periodical regressions. He does, however, explore in detail - as one possible solution - the idea of steady-state growth, where no single state is optimal, whereas the succession of states is optimal. His discussion is curiously made in terms of physical and biological analogies: he seems to conceive the universe as an entity that up to its maturity is analogous to a growing organism and from maturity onwards analogous to a body moving according to the law of inertia.

The reason for Leibniz' hesitation is, as mentioned above, the problem of reconciling the laws of conservation with a theory of

perpetual progress. There does exist one text where he finds what would appear to be the logical solution to the problem: even if the perfection of the universe as a whole is constant, there may be subsets of the universe that perpetually increase in perfection, at the expense of a perpetual decrease elsewhere. Such a subset of increasing perfection might be the human corner of the universe. This is roughly similar to the theories that reconcile economic progress with the second(rather than the first) law of thermodynamics, by pointing out that there may be a local reduction of entroyp on the condition of an even greater increase taking place elsewhere. This solution is logical, but in most of the texts Leibniz sees society as a microcosm rather than as just a part of the macrocosm. He seems to seek for laws that should be equally valid for the part and for the whole, and without committing the fallacy of composition you cannot hold that all the parts may simultaneously grow at the expense of other parts.

14. Growth and crises. In some remarkable pages Leibniz explores the mathematical structure of all the logically possible philosophies of history, distinguishing in one text between the line, the circle, the oval and the spiral, and in another text discussing the movements of maxima and minima that would make for all-over growth. It seems correct to say that Leibniz is very much attracted by the image of a spiral, being a combination of the linear progress and the periodic recurrence. He very clearly states that the regressions are not just an accident de parcours, but are indeed necessary conditions for long-term growth. "Reculer pour mieux sauter" is one of his favorite expressions in this context. In one of his most profound metaphysical texts he even compares this irregular progress to the periodic agricultural depressions, well-known in Germany litterature from the end of the

16th century.

The Leibnizian theodicy may be compared with Marx, Weber and Schumpeter. Of the latter Schumpeter's theory of capitalism is certainly the most subtle one, being so to speak a three-level theory of rationality. At the first level we find the individual entrepreneur, with his formal and instrumental rationality. At the second level we find the systemic irrationality that is produced by the anarchy of first-order rationalities. At the third level, however, Schumpeter finds that the short-term irrationality and inefficiency are conditions for long-term rationality. Weber never moved beyond the first level, the rationality of the individual. Marx never moved beyond the second, the systemic irrationality. Leibniz started at the second and arrived at the third. Leibniz did indeed see that at any given moment of time the universe is less-than-optimal, but he did not as Schumpeter link this suboptimality to the first-level rationality of the individual actors. To the extent that the first-level rationality enters into the Leibnizian world picture, it is as an imperfect analogy with the divine calculus and not as an autonomus causal agent.

15. Some unexplored topics. Leibniz is a pioneer in the theory of games and economic behaviour. Both as an economist and as a political philosopher he was concerned with the strategic aspects of interaction, where the environment is not seen as constant but perceived as a set of actors that are themselves rational and calculating. He does arrive at a primitive version of the maxi-min principle in simple strategies. He also proposes a theory of risk diversification, without linking this to the theory of games. It may be mentioned as a curiosity that Leibniz was very interested in

the Chinese game of wei-ch'i(better known in the West as go), which he rightly saw as a model of warfare through attrition and encirclement.

Leibniz also pioneered in the theory of social security, where he argued against the distinction between objective causes of accidents (lightning or tempest) and subjective causes(drunkenness or aversion to work); in the exploration of patent systems, which were of crucial importance at that particular juncture of history; in the theory of inflation and in many other domains. In almost all his work he gave first principles only, which are rarely worked out. Still the first principles are often very good principles.