EIRFeature

An 'American Century' seen as a modular mathematical orbit

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*The present report is the fourth in a series of **EIR** Features addressing those most crucial, but rarely understood issues, which demand immediate correction of the U.S. Government's continuing, wishful refusal to address the realities of the ongoing, global financial and monetary collapse.*

*The first of these four items, entitled "Russia Is Eurasia's Keystone Economy," was supplied as a companion to a report by Russia's Dr. Sergei Glazyev; that article appeared, together with Dr. Glazyev's, in the March 27, 1998 edition of **EIR**.[1] The second of this series, "The Substance of Morality," which focussed upon one of the crucial themes, cultural determinism, addressed in my March 27 report, was published as an **EIR** Feature in the June 26 edition. The third, which appeared in the July 17 edition, "Where Franklin Roosevelt Was Interrupted," analyzed that disastrous succession of changes in post-1945 U.S. economic and strategic policy-making, which has led to the presently ongoing collapse of the world economy.*

The present report clarifies the technical side of the issues addressed in the July 17 report. It defines the mathematical[2]

form of the differences between two sets of U.S. economic policies. It compares, thus, on the one side, the implied axioms of what had been proposed, while Franklin Roosevelt was still alive, as the post-1945 world economic order, "The American Century," to, on the opposing side, the axioms of that self-doomed, globalist, financial and monetary order, the which was established during the course of the recent thirty-odd years. Here, we examine the principles underlying the mathematical (modular) form of those technicalities which show why a New Bretton Woods financial and monetary system would be successful, and any failure to institute that system, now, a world-wide catastrophe.

To restate that task: our approach here focusses upon the mathematically axiomatic form of those principles of so-called "human ecology"[3] which really underlie a world economy. We compare those elements of so-called "ecology" to the best of the extant principles of modern physical science, principles which were introduced to modern science as the Gaussian ordering of our Solar system. Within each of the two distinct systems so compared, the Solar system and growth of

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1. Dr. Sergei Glazyev, "Key Measures for a Transition to Economic Growth in Russia," issued January 1998 as a transaction of the upper house (The Federation Council) of Russia's parliament.

2. As used here, "mathematical" refers to the Gauss-Riemann system of multiply-connected manifolds, the latter otherwise referenced as *hypergeometric,* or, in descriptive terms, *modular* functions. These conceptions are derived, chiefly, from the successive pioneering work of Johannes Kepler and Gottfried Leibniz, and in crucial opposition to the more popular classroom

notions of "analysis" derived from such followers of Paolo Sarpi's Venetian school as Galileo Galilei, Thomas Hobbes, René Descartes, Isaac Newton, Leonhard Euler, Lagrange, Laplace, Cauchy, and Clausius.

3. As stated earlier, the recent decades' popularized effort to apply the methods of Darwin-Huxley animal "ecology" to human populations, as by the fellow-travellers of Prince Philip's World Wildlife Fund, is sheer quackery. The very subject-matter, as popularly discussed in recent decades, is possible only among charlatans who lack the meagrest sense of scientific literacy. Here, we are *contrasting* the principles of human population to those of popularized notions of "ecology."

President Franklin D. Roosevelt addresses Congress during World War II. "The practical task confronting today's mathematical economist," writes LaRouche, "is to define the calculable difference between the kind of 'American Century' world economy implicit in Franklin Roosevelt's policy, and the disastrously contrary kind of 'economic solar system' which has evolved—especially—during the recent thirty-odd years."

human potential relative population-density, *we are given a variety of objects included within the system as a whole, each object moving in a way which is peculiar to itself, and yet, as Kepler and Gauss have shown for the Solar system, each of these planetary and other trajectories within the same set, is governed by a common, underlying set of principles regulating the behavior of the system as a whole.*

In the third report of this series, I focussed upon the difference between the kind of world economy which would have existed during the recent fifty years, had President Franklin Roosevelt lived, and the spiral of economic degeneration which has ruled during most of those fifty years to date. These two economic histories, are to be contrasted as analogous, respectively, to two entirely incompatible conceptions of the ordering of our economic "Solar system." The practical task confronting today's mathematical economist, is to define the calculable difference between the kind of "American Century" world economy implicit in Franklin Roosevelt's policy, and the disastrously contrary kind of "economic solar system" which has evolved—especially—during the recent thirty-odd years. The task is to show how to calculate and manage those apparently minuscule, momentary differences in trajectories which define the process leading to directly opposite medium-term and long-term results: to show why the economies within one economic "solar system" must necessarily follow qualitatively different trajectories than those of the other, the one leading toward prosperity, the other toward doom.

In the language of those who followed President Charles de Gaulle's relatively successful, Hamiltonian principles for "indicative planning,"[4] the question is: how can we adjust the flows within economic processes, to the effect, that future performance of the economy as a whole is kept within strategically acceptable standards of physical and social performance?

Respecting those principles of astrophysics which we must borrow, as obligatory for understanding the defining issues of any competent mathematical economics, the reader is referred to a pedagogical summary of Kepler-Leibniz-Gauss astrophyics, supplied, under the title, "How Gauss Determined the Orbit of Ceres," by Dr. Jonathan Tennenbaum and Bruce Director, in the Summer 1998 edition of **Fidelio** *quarterly.[5]*

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4. The modern precedent for "indicative planning," is the so-called "dirigist," science-driver program of France's minister Jean-Baptiste Colbert. This, in turn, was the basis for the first introduction of a science of technology to national-economy, the 1792-1794 program of France's war minister Lazare Carnot. Carnot's principles of technology were fused with the "dirigist" program of Treasury Secretary Alexander Hamilton's famous three reports to the U.S. Congress. Despite the corruption of France's science, since the takeover of France's *Ecole Polytechnique* by the positivists Laplace and Cauchy, the anti-positivist Ecole tradition, as typified by Louis Pasteur, remained that current within France's tradition which was reflected in the "indicative planning" approached instituted under President de Gaulle.

5. I induced Tennenbaum, Director, and others to undertake the subject of that series of pedagogical exercises for the included purpose of prompting at least some among my associates to develop a more rigorous insight into the

Entropic and anti-entropic systems

In any formal mathematical system derived from those Ockhamite, mechanistic principles of so-called "analysis," the which were employed by Galileo Galilei and his student Thomas Hobbes,[6] the mathematically characteristic feature of that system, taken as a whole, is a process of degeneration often identified, during the literature of the recent two centuries, by the term "entropy."[7] Examples of such characteristically *entropic* systems, include not only the reductionist mechanics of Isaac Newton's dubious parody of Kepler's work, Newton's *Principia,* but also the "free trade" system specified by John Locke, Bernard Mandeville, the neo-feudalist François Quesnay,[8] Adam Smith, Jeremy Bentham, and John Stuart Mill.

Closely related types of degenerative systems, closely related to both empiricist mechanics and modern statistical social theory, include the so-called "information theory" of Norbert Wiener et al., and the "systems analysis" of John von Neumann. As Wiener has stressed, the derivation of the so-called "H theorem," by Ludwig Boltzmann, is a paradigm for both these general classes, mechanical and social, of such characteristically degenerative systems.[9]

The relevant paradox is, that living systems, including any college textbook-writer, or lecturer, who preaches "universal entropy" as a dogma, are, despite themselves, characteristically *anti-entropic* as types of organisms. In that sense, the professional honor of the positivist professor of biology depends curiously upon proving, implicitly, to his students, that he himself does not, and could not exist.

Fortunately for the existence of our species—and our universe—anti-entropic processes do exist in categorically universal types. Classical science and art are filled with successful examples of such universal processes. As first argued in this way by Plato, and by the founders of modern experimental physical science after him, the lawful principle underlying the ordering of our universe, is characteristically *anti-entropic*.[10] This includes the principles underlying the design of our Solar system, as Gauss's work provides crucial experimental proof of Johannes Kepler's argument on this point.

This same principle of *anti-entropy,* is the characteristic distinction of successful economies, as shown by the science of Physical Economy, founded by Gottfried Leibniz, and shown by such products of Leibniz's influence as the "American System" model of Alexander Hamilton, Friedrich List, Henry C. Carey, and U.S. President Abraham Lincoln. U.S. President Franklin Roosevelt's economic recovery program shares this anti-entropic distinction from catastrophically failed economic policies, the latter typified by the pattern of the U.S. government's net policy-changes imposed during the recent thirty-odd years.

As I have demonstrated this repeatedly, the characteristic features of a successfully anti-entropic economy, may be expressed in terms of a modular, *multiply-connected manifold* of inequalities.[11] However, this modular system can be expressed *only* in terms of a set of physical-economic parameters, as opposed to measurements made in terms of simple money prices or other commonly used, fictitious terms. The

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principles underlying a science of physical economy. The *Fidelio* feature was produced as a polished version of the series presented earlier in Saturday morning editions of the Labor Committees' Daily Briefing supplied to friends and associates of our philosophical association.

6. Although Nicholas of Cusa, Luca Pacioli, Leonardo da Vinci, and Johannes Kepler represent the origin of modern experimental physical science, a pro-feudalist, anti-science counterrevolution was launched by Venice's Aristoteleans. This Aristotelean reaction dominated Europe politically throughout the Sixteenth Century, especially beginning the A.D. 1510-1511 betrayal and defeat of the League of Cambrai. During the course of the Sixteenth Century, the Aristoteleans became divided into two leading factions, one nominally Catholic, the other, predominantly, nominally Protestant. The neo-Aristotelean Protestant current of empiricism originates with the revival of a medieval figure, William of Ockham, by Venice's Paolo Sarpi. Among his leading roles, Sarpi was the controlling figure behind the emergence of the Sixteenth-Century Netherlands and English monarchies. In mathematics, Galileo Galilei was a personal lackey and student of Sarpi, and Francis Bacon and Galileo student Thomas Hobbes are among the notable purveyors of Sarpi's Ockhamite method. The entirety of what is known today as the methods of René Descartes and the English empiricists (such as John Locke, Isaac Newton, et al.) are directly products of Sarpi's Ockhamite dogma. Thus, modern European scientific thought was divided among three schools, the feudalist reaction against science, the followers of medieval Aristoteleanism, traditional science (Cusa, Leonardo da Vinci, Kepler, Leibniz, et al.), and empiricism. During the Eighteenth and Nineteenth Centuries, the apostles of empiricism commonly defined the leading current of modern science (Cusa, et al.) as "continental science."

7. In the literary debate between Gottfried Leibniz and Isaac Newton's controller, Dr. Samuel Clarke, Leibniz emphasizes the importance of Newton's admission that Newton's empiricist universe is comparable to a clock which runs down in such a fashion that God must, periodically wind up the unfortunate creation. Newton's "clock-winder" observation is the prototype for what Clausius, Kelvin, et al. later identified as thermodynamical "entropy."

8. Politically, Enlightenment figure Dr. François Quesnay, was an apologist for the feudalist tradition of the Seventeenth-Century *Fronde*. His irrationalist dogma of *laissez-faire,* copied by the British East India Company's propagandist Adam Smith as "free trade," reflects the neo-feudalist political basis for the British Haileybury economists such as Smith, Thomas Malthus, David Ricardo, and, with modest qualification, Karl Marx.

9. Norbert Wiener's piece of quackery, his "information theory," was derived from the same empiricist root, as entropy was defined, mechanistically, by Ludwig Boltzmann. Cf. "The Substance of Morality," *EIR,* June 29, 1998.

10. Most notably, Nicholas of Cusa, Luca Pacioli, Leonardo da Vinci, and Johannes Kepler.

11. This is the form of mathematical physics developed, chiefly, through the successive work of Johannes Kepler, Gottfried Leibniz, Carl F. Gauss, and Bernhard Riemann. In the application of this to the science of physical economy (see text immediately following), I have followed Riemann in correlating an increase of the number of experimentally, crucially validated physical (and cultural) principles with a *characteristic* increase of the potential relative population-density of the corresponding society. The realization of this economic potential as increase of the productive powers of labor (per capita and per square kilometer of the Earth's surface-area), is expressed in terms of a set of constraints specifying the preconditions for realizing that potential. This set of constraints defines anti-entropy in mankind's functional relationship to the universe at large.

required measurements must express the characteristic function of an anti-entropic physical-economic process in terms of relative increases of the human species' power over the universe, per capita and per square kilometer of the Earth's surface-area.

The question thus situated is: What are the functional determinants of such a physical economy's relative success, or failure, to increase the (per capita, per square kilometer) anti-entropy of the society as a physical-economic entirety? As elaborated in earlier reports of this *EIR* series, this question focuses attention upon two interconnected, Riemannian, functional arrays. These two arrays I have distinguished, as, on the one side, the ongoing realization of accumulated, validated knowledge of physical principles, as from (from n to n+1), and a similar, interacting array of what are best identified as "Classical" cultural principles, as from (from m to m+1).[12]

The primary functional characteristic of an anti-entropic physical-economic process, taken in its entirety, is the transformations expressed in terms of a function of both $(n \to n+1)$, $(m \to m+1)$. These transformations must also be expressed, as realized in practice, in terms of those characteristic physical-economic functions which I have represented in my textbook, and elsewhere: in terms of a table reflecting a *paradoxically* anti-entropic set of inequalities.[13] [See box, p. 30.] These functions, including the discovery and use of discovered physical and cultural principles, do not depend upon any notions of money-price or monetary relations as such; as I have detailed this in various published locations, these functions are purely physical-economic, not monetary.[14]

However, although the laws of the economic process itself lie entirely within the domain of physical economy, rather than financial and monetary relations, modern political economies, as Treasury Secretary Alexander Hamilton, for example, defined them, are the result of the superimposition of political institutions of finance and monetary relations upon the underlying, physical-economic processes as such. The mathematical representation of any actual form of modern political-economy, whether Hamilton's "American System of political-economy," or adversary systems such as the Adam Smith model, then depends upon showing the form of interactions, as expressed in non-monetary, physical-eco-

nomic values, which are the result of imposing a financial system, in terms of money-prices, upon a purely physical-economic process which has no intrinsic connection to prices.

Stated or implied price, whether expressed in money-prices, or in terms of barter, or even simply theft, becomes a principal means by which the flow of physical-economic wealth produced is directed, or diverted ("allocated"), subjectively, as a flow, into one or another channel of consumption (or, waste). Under a price-dominated form of political-economy, whether the flow of physical-economic values goes to foster the increase of the productive powers of labor, or into pure waste or other entropic expressions, will do much to determine whether the economy, as measured in purely physical-economic terms, prospers or degenerates.

Nonetheless, although money-price and related fictitious valuations can exert social control over the flow of allocations from and into the real economy, it is the physical-economy as such which determines the ultimate outcome of those allocations. Just so, the case of the well-designed automobile driven by a drunken madman; the accident is the result of misusing the automobile, an accident caused by allowing that automobile to be operated by an incompetent. So it is in economics; the best designed economy, operated by monetarists, will crash, through no fault of the ruined economy itself.

To offset the entropic evils to which the mechanistic (i.e., entropic) form of a money-system is otherwise susceptible, prudent governments regulate currency and, to a certain degree, also prices, and prune and shape the channels of public credit and taxation, all to foster the allocation of physical-economic resources to anti-entropic ends, rather than entropic, or outrightly parasitical forms, such as financial speculation. Without such political regulation by perfectly sovereign nation-state government, all modern *political economies* are inherently entropic on principle. This is so, for the elementary, mathematical reason, that the mathematical relations defined in terms of money-price exchanges, are, like John von Neumann's "systems analysis," inherently linear, entropic relations.

If the system which is employed for making decisions respecting allocation, is a system which presumes, implicitly, that economic relations are to be ordered entropically, then the apparently "correct" decisions made on the level of financial and related decisions, will superimpose the relations of entropy upon the underlying, physical-economic system. Without the intervention of government to foster maintenance and development of basic economic infrastructure, to provide the advantages of protection to preferred, technologically progressive forms of employment, production, and trade, the entropic effects inhering in the money-system would lead to entropic degeneration of the economy — *as they always have!*

However, although the role of government in regulating economy is indispensable, it must not go so far as to degrade the real economy to one administered by crude, linear, bureaucratic accounting rules.

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12. E.g., "Russia Is Eurasia's Keystone Economy," "The Substance of Morality."

13. All validatable discoveries of principle, whether physical principles or principles of Classical forms of artistic composition, are presented by apparently insoluble paradoxes. Such is the role of Classical metaphor in poetry and drama. The paradox lies in the troublesome evidence; the solution for the paradox exists only as a validated discovery of the relevant principle, which latter eliminates the paradox by creating an appropriately expanded new domain, now known to correspond less inexactly to the real universe. The fact that the *anti-entropy* of my system of inequalities occurs as a deductively insoluble paradox, is the virtue of the system. Anti-entropy could never exist in any other form.

14. LaRouche, *EIR,* op. cit., March 27, 1998.

Our best political leaders, such as Benjamin Franklin, Alexander Hamilton, and President Abraham Lincoln, were profoundly sensitive to the necessary distinction between an imperative degree of governmental direction in the economy (as, for example, in the domain of regulated basic economic infrastructure), as opposed to excessive direction of the fine details of the productive and allocative processes in the relatively smaller elements of the economy.

France's President Charles de Gaulle exhibited similar sensitivity, most effectively, in his government's emphasis on "indicative planning." Government must be sensitive to the importance of rather sharp distinctions between "direction" and "encouragement." In a well-ordered national economy, the proper distinctions between governmental direction, on the one hand, and government's encouragement, on the other, are an integral part of the means by which national

An anti-entropic set of inequalities

*The following discussion on "a paradoxically anti-entropic set of inequalities," is excerpted from "The Essential Role of 'Time-Reversal' in Mathematical Economics," which appeared in the Winter 1996 issue of **Fidelio** magazine and **EIR**, Oct. 11, 1996. For further discussion, see LaRouche's textbook, **So, You Wish to Learn All About Economics?** (Washington, D.C.: EIR News Service, Inc., 1995).*

Let **V** signify input/output of the labor-force, **C** signify required materials input for the entire economy (functionally defined), **F** net (functional) physical capital, **d** necessary deductions for government and administration otherwise, **S** output in excess of *energy of the system*, and **S′** *free energy* (after deductions for both necessary administration and waste). Be reminded: read these symbols as defined here, not the Marxist reading. Prepare the way by describing the constraints to be examined, as follows.

The general constraints are:

1. The potential population-density of the economy (as a whole) shall not be decreased, and the demographic characteristics of the population as a whole shall be improved.

2. The inputs and outputs of the "market baskets," and of their contents, shall be increased in absolute (physical) terms, for households, for performance of infrastructure, for agriculture and related, for industry, for education, for health care, and for science and technology services. These increases shall be measured in market-baskets, also as contents of market-baskets, and in terms of per-capita (of labor-force), households, per-square-kilometer of land area.

3. The ratio of "free energy" to "energy of the system," so defined, shall not decrease, but the relative energy of the system (per capita of labor-force, per household, and per square kilometer) shall be increased through reinvestment of "free energy" generated.

These seemingly paradoxical requirements may then be expressed as:

Population-density (adjusted for demographic parameters):

$$|(F)\ P_1| \le |(F)\ P_2|$$

"Free Energy" Ratio:

$$\left[\frac{S_1'}{(V_1 + C_1)}\right] \le \left[\frac{S_2'}{(V_2 + C_2)}\right]$$

"Energy-Density" Ratio (per-capita of labor force):

$$\left[\frac{(V_1 + C_1)}{F_1}\right]_1 \ge \left[\frac{(V_2 + C_2)}{F_2}\right]_2$$

But, the physical content of market-baskets (M) for productive functions, per capita, for labor-force:

$$(M_v)^1 \le (M_v)^2$$

and:

$$(M_c)^1 \le (M_c)^2$$

This set of "market-basket" relations overlays a set of constraints defined in terms of divisions in output of employment of the total labor-force's operatives, letting **V** correspond to the operatives' ration of the total labor-force. In this case:

$$\left(\frac{V}{C}\right)_1 \ge \left(\frac{V}{C}\right)_2$$

and:

$$\left(\frac{S'}{V}\right)_1 \le \left(\frac{S'}{V}\right)_2$$

and:

$$\left(\frac{S'}{V + C}\right)_1 \le \left(\frac{S'}{V + C}\right)_2$$

economic policy induces a desirable degree of self-regulation of the allocation function in the role of price and income mechanisms in the market-place.

The alternate management and investment principle, that of "encouragement," is not a matter of mere moderation, mere avoidance of what some ideologues profess to abhor as a "command economy." The emphasis upon encouragement flows from the nature of the way in which those ideas responsible for scientific and technological progress are generated: solely by the developed cognitive processes of the individual mind, not collectively, never by "popular opinion."

This means the individual entrepreneur's and operative's accepting the task of the fostering of the discovery and employment of ways to make "more and better" from the same amount of (total) exertion applied to that effort by society as a whole. The success of this commendable desire, depends upon the individual decision-maker's willingness to submit to the guidance supplied by validated discoveries of both physical principle and Classical forms of culture. This includes not only the individual's reliving the acts of valid such discoveries from earlier cultures and generations, but also validated new discoveries achieved currently in a similar (e.g., Classical) mode.

Wherever allocation decisions can be safely left to the developed cognitive powers of individuals, or small groups of such individuals, it is better to encourage this practice. However, wherever the general welfare of society is explicitly involved, especially the welfare of the sovereign nation itself, in correct decisions, as in the case of development and maintenance of basic economic infrastructure, or national security, the authority and responsibility lies properly with government. Wherever the development of the general land-area, or the general welfare of the entire population is the leading practical issue, private decision-making must yield to the regulatory functions of government.

The disadvantage of governmental decisions is derived not only from the inherent tendency of popular opinion toward mediocrity. The very tendency to rely upon collective (e.g., "collegial") decisions, rather than decisions based upon validation of principle, is itself a well-spring of mediocrity. This kind of mediocrity tends to be characteristic of very large corporate enterprises, not only because those enterprises are usually run by amoral Wall Street pirates, but because most large bureaucracies (private usually worse than public) tend to hide behind the mutual protection of collective moral and intellectual mediocrity.

It is the relatively exceptional individual, whose cognitive potential has been developed by means of an approximation of a Classical-humanist form of general education, who contributes those exceptional ideas by means of which progress is supplied to the population and economy generally. Hence, the superior physical-economic performance of the high-tech, closely held entrepreneurship, as typified by the successful machine-tool-design enterprise, over the large, publicly held

corporation. Thus, we representatives of the American System of political-economy, have always preferred that government assume responsibility for fostering those preconditions, including a fair approximation of a Classical-humanist form of compulsory public education, conditions which must be satisfied in the interest of encouraging the efforts of private groups to promote a world of "more and better." For the same reason, the authorities and responsibilities of the sovereign nation-state republic, must never be subjected to the entropic anarchy inherent in "globalization" and general practices of "free trade."

The nature of the core issues involved in making these distinctions, is made clearer by two cases in point.

The Machine-Tool-Design Principle

For reasons we have elaborated in already referenced locations, the heart of the successful form of modern agro-industrial, national economy, is represented by two functionally interconnected features of all the more successful economies. One is compulsory, universal (predominantly) public education, with emphasis on Classical education in principles of science and culture, as opposed to the intellectual sterility inhering in so-called "job-oriented," "skill-oriented," "popular," or "relevant" education. The second, is the economy's machine-tool-design sector.

As we have stressed, the two features are closely interrelated functionally. The natural expression of a student's reliving the act of a validated original discovery of physical principle, is a proof-of-principle experiment. Any valid, crucial proof-of-principle experiment, is a model for a corresponding principle of machine-tool or related design of a *technology*. On this account, the flow of compulsory, Classical forms of public education into the fostering of university and related research functions, should lead, in turn, into encouraging of development in the machine-tool-design sector of the economy. The continuing role of President Abraham Lincoln's policies, even after his assassination, in the development of the agriculture and industry of the U.S.A., typifies the cases to be considered.

Today, globally, the admittedly disintegrating, present-day, German machine-tool industry, remains, still, if only vestigially, the paradigm of viable forms of machine-tool industry in general.[15] This is a model introduced to Germany from the United States during the 1870s, as typified by the role of Thomas Edison's collaborators, such as Rathenau and Siemens, in electrifying late-Nineteenth-Century Germany. That is the American-German historical mode implicitly referenced here.

In practice, we should divide machine-tool enterprises into two types. The more common type is the relatively ordi-

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15. Lothar Komp, "The Crucial Role of the 'Mittelstand' in the Economy of Postwar Germany," *EIR,* Jan. 1, 1997, and "The Era of Deindustrialization Has Now Reached Its Dead End," *EIR,* Feb. 7, 1997.

nary machine-tool establishment, whose typical practice is to polish up and broaden the application of already established machine-tool-design principles, this to the purpose of producing both better machine-tools, and other products, generally. The second, more sophisticated type, is the firm whose practice features the frequent introduction of the application of entirely new, revolutionary principles of technology: new principles of the type which flow directly from the crucial validation of newly discovered physical principles. This latter is the type of firm which is most closely associated with the

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One can not purchase cognition by the bucket-load, or the kilogram, or measure it by counting; nonetheless, its existence, and the efficiency of its existence as action, can be readily demonstrated, and measured. By what means, and how to effect such measurements, is the mathematical side of economic science.

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development of apparatus essential to crucial proof-of-principle experiments, including "crash programs" such as the Manhattan Project or German-American aerospace program, illustrate the case. Both types of machine-tool enterprises are important; however, the second of the two types is crucial for the process of continued revolutionary progress in the productive powers of labor world-wide.

The latter type of firm, is, typically a small-to-medium-sized enterprise, usually closely held, which employs between several to not more than a few hundred employees. The owner-management of such a firm is controlled by individuals who are highly innovative physical scientists, or engineers with comparable skills and impulses. "Business school" and "Wall Street" types are, almost invariably, a menace to the successful continued existence of such enterprises. The owner-entrepreneur of this second type of machine-tool firm is, as we have said, a direct link to the process of new, experimentally validated discovery of physical principle. In recent history, the typical point of reference for the highest rates of progress in such industrial machine-tool-design practice is, as we have just said, the military or other science-driver "crash program," such as the Manhattan Project or the German-American U.S. space program of the 1950s and 1960s.

A similar pattern is found, from earlier times, in the best agricultural practices of the U.S. and German farmer, for example. The influence of Justus von Liebig's work on the origi-

nal founding and development of the U.S. Department of Agriculture, is an apt example of the similarity of the connections between science and technological revolutions in economic practice.

The crucial connection, is between, first, the general development of the creative powers of the individual minds of nearly all of the members of society, as through a compulsory, universal, Classical-humanist form of education, and, second, the realization of the developed creative powers of the student's mind in the forms of scientific-technological and artistic expressions. The machine-tool-design sector of the economy, is therefore the crucial element, and pinnacle of employment of the productive sectors of the agro-industrial population as a whole; this is the area of production in which the highest rate of increase of the productive powers of labor is concentrated. As the portion of the total labor-force employed in this machine-tool-design area increases, so the potential growth of the productive powers of labor is generated.

By contrast, "outsourcing" for the apparent benefits of cheap labor, as typified by the continuing, disastrous impact of the NAFTA program upon both the U.S.A. and Mexico economies,[16] has shown itself to be a form of economic suicide for both nations, as similar effects have been experienced in those areas of Southeast and East Asia once associated with the reputation of "Asian Tigers." The source of the productive powers of labor is that which sets the human individual absolutely apart from, and above the apes: those cognitive powers of the individual human mind which rascals such as Immanuel Kant and Karl Savigny denied to exist.[17] The source of the

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16. The ruin of General Motors through increasing reliance on slave-labor conditions of production in Mexico's *maquiladoras,* is most exemplary of the way in which Wall Street bandits' unchecked, moronic cupidity ruins an entire, once proud and powerful industry, and wrecks the U.S. economy generally, by the same means expressed in other ways. In the U.S.A., as in the tottering nation of Japan, the transfer of financial and political control over industries and the economy to those young upstarts who substituted a fast-buck trader's electronic calculator for a human brain, generally creates a situation in which the revival of the wrecked economy becomes impossible, unless this entire class of overpaid parasites is removed from positions of power.

17. Immanuel Kant's early development appeared in the form of fanatically anti-Leibniz tracts expressing extreme adulation for the empiricist influence of Britain's David Hume. By the early 1780s Kant had undergone a change, distancing himself somewhat from Hume. Kant refers to this change in both the first edition of his own *Critique of Pure Reason* (1781) and his *Prolegomena* (1783). There, Kant later distanced himself from the Ockhamite "philosophical indifferentism" of the British empiricists, and rooted himself entirely in the Averroës tradition of the Venetian gnostic Pietro Pomponazzi. The essence of Kant's neo-Aristotelean doctrine, was the argument that the cognitive powers of the individual human mind are *unknowable,* and should therefore be disregarded. In his last *Critique,* the *Critique of Judgment* (1790), Kant carries that attack against cognition to its extreme, arguing that aesthetics is a purely arbitrary (irrational) choice of current opinion. Kant's latter view provided the basis for G.W.F. Hegel's notion of an arbitrary "World Spirit," and the notion of an entirely irrational *Geisteswissenschaft* by Hegel's right-wing crony Karl von Savigny. Today's popular empiricist notion of "art for art's sake," is a product of the same irrationalist argument of Kant, Hegel, and Savigny.

productive powers of labor, is nothing other than that development of those individual cognitive powers, a development best accomplished by aid of cultural standards associated with a Classical-humanist form of compulsory general education, and the nurture of the family household and each local community in a manner consistent with the development and employment of that individual human potential.

A Classical-humanist form of compulsory general education, combined with the leading role of the machine-tool-design sector in physical economy, typify the most essential components of modern economic progress. The question is, how might we approach the task of *measuring* this role of cognition within the economic process as a whole? This turns our attention back to the implications of Kepler's founding of the first successful effort at establishing a comprehensive form of mathematical physics.

Kepler's notion of reason

At first, to the novice, the modular mathematical method developed by Kepler appears to be a method of successive approximations.[18] We begin with consideration of the solar year, add the qualifying notion of the sidereal year, add such other, interacting periods as the equinoctial cycle, and so on. We are moving on a moving planet within our Solar system, a Solar system which, itself, is undergoing long-range cycles of internal change, a Solar system otherwise in motion within the galaxy, and so on. In addition to such orbital changes, there are other periodicities to consider. Each step of refinement of this colligating accumulation of "cycles," leads us deeper into the recesses of non-constant curvature in the infinitesimally small, and thus gives us a new, more precise frame of reference for locating our relationship, from our place on Earth, to the universe at large.

Reflection on these successive approximations returns our attention, once more, to one of the most crucial of the dialogues of Plato, his *Parmenides.* The question is, is there some permanent principle underlying each and all of the conditional changes introduced as crucially validated steps of successive approximations? For Kepler, as for Plato before him, the answer was, "Yes. There is the universal principle of Reason." Understanding this principle is key for locating the nature of measurement of physical-economic processes. *What principle governs the mind's successful ordering of such a series of what are apparently successive approximations?* It is that ordering itself which reflects what Kepler and Leibniz identify as the principle of Reason.

Consider, first, the way in which we measure the principle of anti-entropy in national economies.

On the one side, we can demonstrate empirically, that increase of the potential relative population-density of cultures, depends absolutely upon a characteristic anti-entropy of action within such cultures. From the standpoint of mathematical formalism, we can not measure that action *directly;*

we measure it indirectly, as the set of my constraints (inequalities), restated above, does that. Nonetheless, despite this apparent formal difficulty in the way of simpler, algebraic solutions, we can prove, and that conclusively, that the efficient agency of cognition is the *necessary and sufficient reason*[19] for the effect measured as the characteristic product of anti-entropy.

One can not purchase cognition by the bucket-load, or the kilogram, or measure it by counting; nonetheless, its existence, and the efficiency of its existence as action, can be readily demonstrated, and measured. By what means, and how to effect such measurements, is the mathematical side of economic science.

On the one side, we can count the addition of an experimentally, crucially validated physical principle; on the other side, we can measure the relative increase in the productive powers of labor brought about through the utilization of new, validated physical principles. This is an experimental validation of a physical principle, a crucial validation effected through measurement, and by methods of experimental physical science. The fact, that the measurements available to us during the short to medium term are seldom better than good approximations, detracts nothing from the authority of the experimental method employed.

In the case of Kepler's astrophysics, and its crucial validation by Gauss, it is demonstrable that all efficient laws of the Solar system conform to the principles of Platonic harmonics, as Luca Pacioli and Leonardo da Vinci also insisted upon this earlier. We can not dump such notions of harmonics upon the Solar system in a mechanistic way, and directly calculate the result accordingly; but no validatable calculation will violate those notions of harmonics. Similarly, no increase of the potential relative population-density of mankind occurs, without the apparently unmeasurable act of cognition; but, although the efficiency of cognition can be shown in a measurable way, one can not derive a simple, deductive (e.g., algebraic, analytical) calculation of the connection between cognition and its physical-economic result.

This kind of distinction, between either cognition and increase of potential relative population-density, or between Platonic harmonics and the lawful composition of our Solar system, is a distinction of a type known from Plato as the difference between ordinary *hypothesis* and *higher hypothesis.* It is the latter, *higher hypothesis,* which supplies the meaning of the term *Reason* in first approximation. It is that distinction which is crucial for a comprehensible notion of a mathematical application of economic science.

Define the relevant distinctions as follows.

Contrary to the street-corner variety of misuse of the term, the correct definition of *hypothesis* is as follows. Given any deductively consistent system of propositions, such as the

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18. Tennenbaum and Director, op. cit.

19. Leibniz's notion of "necessary and sufficient reason," is a refinement of Kepler's notion of Reason as the efficient agency determining the laws of the Solar system.

theorems of a classroom Euclidean geometry, each of the theorems of that system must have been proven to be not inconsistent with any among a certain set of interacting, inter-dependent definitions, axioms, and postulates. That latter set forms the axiomatic basis for that system. Among literate persons, such an interacting (modular) set of definitions, axioms, and postulates, is termed an *hypothesis*.

There are other types of systems, which do not depend upon strictly deductive consistency; but, for all types of hypothesis, equivalent principles of connection apply.

In a rigorously developed system, such as a reasonably good mathematical physics, science is frequently replacing previously established hypotheses with new, and better ones. Measurable paradoxes erupting within a domain previously assigned to a known hypothesis, force science to discover new physical principles (for example) which overcome the paradoxes posed by the relevant experimental evidence. Crucial experiment, usually based upon refined measurement, is the means by which such discoveries of new principle are validated.

In no such case is a new principle actually generated by a preexisting mathematics. In each case, a revolution, imported from outside mathematics, is required. Mathematics comes into play as we seek to define crucial proof of the validity of the proposed new principle which we may believe we have discovered as the proposed solution to an experimental paradox. The relevant question is: Since the solution to the paradox is not generated from within pre-existing mathematics, whence does it come?

The student who has often relived successfully the enactment of those valid such discoveries of principle which were originally contributed by persons who lived in earlier generations, develops what appears to be an "instinct" for validatable, creative, cognitive solutions for new problems of the same general class. This "instinct" becomes the emerging basis for a matriculated student's professional competence in his or her field.

This apparent "instinct" is a quality of hypothesis of a far different type than that we associate with ordinary mathematical-deductive systems. It is of a type which Plato associates with the usage of *higher hypothesis*, a set of principles which, when confronted by paradox, efficiently governs the successful, cognitive generation of validatable new principles overcoming the paradox.

Such a notion of *higher hypothesis* belongs to a domain for which the term *epistemology* has often been used. By "epistemology," we imply answerable responses to the question, "How is our universe composed?" Kepler's development of the first comprehensive mathematical physics, is an example of the practice of epistemology. The answer to the question, "How is our universe composed," is both the notion of *higher hypothesis* and the notion of *Reason,* or *necessary and sufficient reason* as these terms appear, variously, in the work of a Kepler or Leibniz. The answer to that question

lies within a crucial second question: "What kind of a person is qualified to answer that question?" If the wrong type of person is involved, the effort will be a failure, usually a travesty.

At this point, we make a short, apparent diversion which is no diversion.

The world-historical individual

At this point we return to a subject addressed within the second of our four referenced reports, "The Substance of Morality." That subject is the notion of the *world-historical individual,* as distinct from the morally inferior, "small change" personality, whose preoccupation is "success" in the narrowly defined, so-called "practical" matters of individual and family affairs. The individual who locates his or her personal identity in making a contribution to the benefits of the past and the future of nation and mankind—our "world-historical individual," thinks about the evidence of experience in a fundamentally different way than does the so-called "practical man." The latter is more or less incapable of the kinds of moral commitment, or profundity of intellectual accomplishments, which are normal concerns for the world-historical personality.

The world-historical personality locates his or her essential identity in the realm of validated *ideas,* as Plato, for example, defines "ideas." That personality is eager to acquire and preserve those ideas, of physical and Classical-cultural principle, which are the gifts of past generations of humanity, and eager to contribute something new of that same nature to the benefit of all future humanity. The motivation of that personality lies chiefly in the joy of mastering those paradoxes which lead to the production of validated, needed new principles, for the benefit of mankind; all true scientists are so motivated, for example. Such is the personality who locates the outcome of his or her mortal existence within nothing less than *the simultaneity of eternity*. That personality, such as a Leonardo da Vinci, a Kepler, a Leibniz, a Gauss, or a Riemann, regards all evidence, including the evidence of physical science, from that world-historical vantage-point.

Thus, in matters of science in general, and economy, the motive of the world-historical personality is the fight for new advances in anti-entropy. That is what shall remain forever of the relatively greatest world-historical value at the most distant place in the simultaneity of eternity. It is anti-entropy as such, anti-entropy as the object of one's investigation, which, for the world-historical person, is the essence of economy. It is that same object, anti-entropy, which is the essence of science for Cusa, Leonardo da Vinci, Kepler, and Leibniz, as it was for Plato. Let us examine that *object,* anti-entropy, as an object. Locate this object, in this manner, within the terms of my table of inequalities.

The proof lies not only in the so-called "objective" evidence considered. Valid proof of principles comes into existence only when the experimenter represents the mind of an

appropriately developed world-historical personality.

For example: in history, over how long a span of time does one measure apparent cause and effect? A few years, a decade, an adult lifetime? Over how broad a span does one assemble the evidence? Generally, the sort of person who has developed the ability actually to think about important economic matters, draws upon intimate knowledge of not less than several centuries of history. That person focusses upon adducing those historical principles, spanning decades, which underlie the origin of recent and current historical developments. In contrast, most among today's middle-aged and younger generations of contemporary university graduates who regard themselves as either professionals, or otherwise well-informed persons, are shallow-minded babblers. They are persons whose minds are dominated by superficial, gossip-like assumptions ("I read the press. I keep up with current events. I studied at school. I hear from people whose opinions I respect, that . . ."), persons whose opinions are not to be treated as products of serious thinking. In short, they have "my philosophy," "my opinion." They are not responsible about the way in which they think and formulate their judgments, whether about science, politics, economics, or morality.

The essential fact of physical economy is human individual, cognitive creativity: the developed capacity, otherwise known as *higher hypothesis,* to meet paradoxes with synthesized, validated solutions expressed as newly discovered physical or Classical-artistic principles. That creativity, that action, is the crucial thing—the object—to be measured; that action is the characteristic of physical economy. The physical dimension we must measure on that account, is anti-entropy.

From reference to the table of inequalities provided above, it is apparent that we do not measure anti-entropy directly. We measure anti-entropy as an algebraically paradoxical relationship arising among measured objects, none of which are explicitly, or otherwise anti-entropic in and of themselves. We are measuring the relatively anti-entropic effect of bringing together, under certain restrictions, algebraically measurable magnitudes, none of which are themselves anti-entropic magnitudes, nor can anti-entropy be adduced from any analytical (e.g., algebraic) formulation of those magnitudes.

To understand the paradox we are elaborating here, it is indispensable to grasp the essential implications of Bernhard Riemann's 1854 habilitation dissertation.[20] It is also indispensable to read Riemann's work from the standpoint of Gauss, and to comprehend these leading features of Gauss's work from the Platonic vantage-point defined by Kepler on modular functions and Leibniz on the subject of non-constant curvature in the infinitesimally small.[21] The following summary of the connections is supplied.

As I have argued the matter in the four *EIR* reports listed at the outset, Riemann's replacement of earlier notions of geometry by his conception of multiply-connected manifolds, has two leading features of relevance for the point immediately at hand. On the one side, the notion of a Riemannian ordering of multiply-connected manifolds, suffices to provide the needed conceptions of not only manifolds of physical principles and of Classical-artistic principles, but also leads us, implicitly, to locating the interaction between the two qualities of manifolds. On the other side, the actual effect of adding new principles to such manifolds can not be determined in a formal way, but must be determined experimentally. Thus, on the latter account, we are led, as Riemann warns us, from the department of formal mathematics, to the department of experimental physics.

In first approximation, it is sufficient for us, that an increase in the number of valid principles of the manifold correlate with a potential increase in the net productive powers of labor, an improvement of the potential relative population-density of the species under conditions of that culture. This improvement, or want of it, is the measurable *characteristic* action within that manifold. This can not be presumed from a formal standpoint, as from simply a geometric standpoint; the measurement of this characteristic must be accomplished in terms equivalent to those of an experimental physics.

The *action* whose effect we are measuring in this way, is the form of activity which sets the human individual absolutely apart from and above all forms of animal life: the quality of cognition which enables the individual mind, as a sovereign individual mind, to generate valid discoveries of new principle in response to the challenge of experimentally paradoxical evidence. It is in that mental activity of the sovereign individual mind, that the characteristic action of physical economy is located.

The fact that we measure this performance indirectly, must not lure us from recognizing the truth of the matter; it is the anti-entropic action characteristic of the sovereign individual mind, which is the sole true object of a practiced science of physical economy. All other considerations are intrinsically irrelevant, except as they bear directly upon this object.

Hence, the typical blunder underlying the incompetence of virtually all taught economic theory, is the blunder of seeking to adduce anti-entropic action from the contemplation of formalist's arrays of entropic objects as such. The typical result of widely accepted economics dogma is, therefore, all too often, like the attempt to extract milk from a ceramic image of a cow. Usually, as most U.S. citizens have reason to complain today, milking a ceramic cow would probably prove a relatively more nourishing endeavor than the kind of economic policy practiced in Washington, D.C., these recent thirty-odd years.

20. Bernhard Riemann, *Über die Hypothesen, welcher der Geometrie zu Grunde liegen, **Bernhard Riemanns Gesammelte Mathematische Werke,*** H. Weber, ed. (New York: Dover Publications reprint edition, 1953).

21. i.e., the basis for Leibniz's devastating attacks upon Descartes and Newton, and the roots of his conception of *monadology*.