2.2 The physical benefit

Those positive functions performed by the modern form of sovereign nation-state republic, which can not be performed effectively by any different form of society, are typified by the following:

1. National sovereignty as such. The assertion of the power to defend the republic and its people against overreaching power of alien (e.g., oligarchical) forms of both domestic and external forces.

2. The power to create and defend the institutions of national currency and credit, as an expression of sovereignty not subject to any external agency, and to defend the currency and production of the nation and its citizens from undesirable foreign or domestic practices.

3. The improvement and maintenance of the condition of the whole territory and population of the nation, including the public health, by means including public improvements in and regulation of the nation's basic economic infrastructure, including the authority to pursue such action despite contrary foreign and domestic interests and influences.

4. The sovereign state's leading responsibility and authority for fostering of progress in science, technology, and the arts, as through institutions of universal education, and by other means.

5. The fostering of investment in scientific and technological progress in what are, in physical terms, capital-intensive and power-intensive modes.

Most of these considerations are summarized in the 1789-1791 reports to the U.S. Congress by U.S. Treasury Secretary Alexander Hamilton. Those reports summarize those economic and related features of the protectionist form of modern sovereign nation-state republic, features which account for all improvements in the conditions of life of nations resulting from establishment of the sovereign nation-state form as successor to the preceding imperial and feudal systems.

The ideas associated with the leading role of U.S. Treasury Secretary Hamilton, were brought more clearly into focus beginning approximately 1814-1815, when representatives of the joint work of France's Lazare Carnot and that Ecole Polytechnique led by Gaspard Monge, came to the United States to assist our West Point Military Academy to develop into the improved form it acquired under Commandant Sylvanus Thayer. This improved, crucial role of West Point in the development of the U.S. economy, to become the world's most technologically advanced, by 1876, was launched through the backing of both President James Monroe, and of Secretary of State and later President John Quincy Adams. Thus, in this historic setting, there began a continuing connection which proved crucial for the fate of our imperilled U.S.A., in the form of our participation in the collaboration between Lazare Carnot and his long-standing scientific ally, Germany's Alexander von Humboldt, as the leading representative of European science working closely with such West Point graduates as Benjamin Franklin's great-grandson, Alexander Dallas Bache.

This collaboration, typified by such results as Thomas Edison's direct role in electrifying both the U.S.A. and Germany—despite both greedy Wall Street and Edison's opponent, the traditionally anti-science ***New York Times,*** exposes the innermost secret of economic science's relationship to the unequalled successes of that revolutionary institution born in Europe during A.D. 1438-1492, that successor to feudalism known as the sovereign nation-state republic.

The crucial question to be considered at this moment, is twofold. The first question is: *As a matter of scientific principle, how is it possible to employ validated discoveries of physical principle, such that those principles become transformed into a self-feeding improvement in the demographic characteristics of populations?* The second, interconnected question is: *How does the institution of the sovereign nation-state republic foster this benefit, as no other form of society has done, or could do?*

For the answer to either of those two questions, or both, we must look back, if only briefly, once again, to the A.D. 1438-1492 interval of European history. We must begin with the founding of modern European experimental physical science, with Cardinal Nicholas of Cusa's 1440 introduction of the method later used by Leonardo da Vinci, Johannes Kepler, and others, to found modern European science, Cusa's ***De docta ignorantia.***

Cusa's ***De docta ignorantia,*** and his other seminal writings on scientific method, intersected and were part of the marshalling of Classical Greek science, chiefly the work of Plato's Academy at Athens, dating, chiefly, from more than sixteen centuries earlier. The work of the Plato Academy's Eratosthenes was a crucial part of what was revived from the Classical science of the years prior to the cultural degeneration of the Mediterranean region under the growing influence of Rome, after approximately 200 B.C. Cusa's discovery of the existence of so-called transfinite cardinalities in geometry, by which he corrected a crucial error of one of Eratosthenes' scientific collaborators, Archimedes, is an example of this connection between ancient Classical and the new modern science launched during the Fifteenth Century.

Cusa's central discovery, of later crucial importance for the development of modern economic science, lay in the realm of scientific method: how to use measurement as a way of *indirectly*—by negation—establishing the existence and nature of physical-scientific principles. The direct result of Cusa's intervention was the establishment of modern experimental physical science, most notably such predecessors of Gottfried Leibniz, Lazare Carnot, and Carl Gauss, as Leonardo da Vinci and Johannes Kepler.[15]

The principal source of the political and economic conceptions of the leaders of the American Revolution, such as Franklin and Hamilton, was two branches of the work of Leibniz. First, on the political side, the Americans' adoption of Leibniz's exposure of the fraudulent character of the work of John Locke, and Leibniz's work of the 1671-1716 interval, on the development of a science of statecraft, including physical economy. It was Leibniz's refutation of Locke which is directly reflected in the "life, liberty, and pursuit of happiness" of our Declaration of Independence, and the notion of "general welfare" in the Preamble of our Federal Constitution. It is principally Leibniz's science which is presented, albeit in an original form, by Treasury Secretary Hamilton's 1791 Report to the U.S. Congress ***On The Subject of Manufactures.***

Carnot's treatment of the principle of design of machines, was developed from the same standpoint, of a Leibnizian geometry of position, which Carnot had also employed for his revolutionary work on fortifications. Carnot's development of the principle of design of machines, which played a key part in "Author of Victory" Carnot's role, as France's military leader at that time, leading France to an absolute military victory in the war of 1792-1794, carried Leibniz's founding of the science of physical economy a crucial additional step forward.

The Abraham Lincoln-launched American economic revolution of 1861-1876, is the outcome of West Point's adoption of the standpoint of Carnot and the Ecole Polytechnique. It is that American agro-industrial revolution of 1861-1876, which changed the world, producing, until the set-backs of the post-World War I period, the greatest rate of general increase of the per-capita productive powers of labor. It was this achievement of 1861-1876 which won much of continental Europe, Japan, and China's Sun Yat Sen, to modelling their own nations' future economies on the model of the Hamiltonian American System of political-economy of Franklin, the Careys, and Friedrich List. It was this same tradition of 1861-1876, which was called upon for the spectacularly successful U.S. war-time mobilization of 1940-1945.

I learned, especially from my own original discoveries in the field of economics in general, and economic forecasting in particular, that solutions to the crucial problems of scientific discovery, are always elementary, but never simple. The successful result may appear simple, but only after the discovery has been made, tested, and proven by means of what are called by the alternate names of either "crucial" or "unique" experiments. Let me now attempt to make the explanation of that obvious to you. This explanation is crucial for understanding how an economy either works, or like the present state of the U.S. economy, does not.

The reason that a discovered and proven principle may appear simple, after it has been discovered and proven, ought to be obvious and simple, too. You may not understand exactly what it is that I am pointing out to you at first reading; but, think about it. Digest the idea, until, later, you have made it your own; it is the most important principle you need to understand clearly, in choosing the educational policies your school must adopt for educating your own and the other guy's children. I shall now state the idea, so that nothing I say on this very important matter is left unexplained.

In physical science, for example, every true paradox is the result of one or a combination of two kinds of axiomatic errors of assumption. Either the experimental subject as studied overlooks one or more of the axiomatic kind of physical principles determining the behavior of that experimental subject, or the observers have superimposed one or more false, axiomatic sort of assumptions upon the investigation. In the simpler type of second case, of gratuitous, axiomatic forms of assumptions, the error may be detected, as being an irrelevant presumption, by applying deductive methods to the experimental evidence. For other cases, deductive methods do not work. In the latter types of cases, the paradox arises from the observer's ignorance of, or disregard of the existence of certain axiomatic assumptions which are both universally true, but are, more immediately, indispensable for that experimental case. Hence, in this latter case, as in all instances of cognitive (i.e., creative) thinking, deduction (e.g., also so-called inductive method) could not possibly work, since the necessary axiomatic assumptions, although physically real, are unknown to the framework in which the paradox is being stated. Hence, all such cases have the form which we term an *ontological paradox*.

Later, once the needed axiomatic assumptions have been located, and proven by crucial methods of experiment, and/or observation, the discovery lends itself to a deductive classroom or similar sort of portrait. All is now readily recognized as elementary, but was never simple until the relevant discovery had first been made and proven.

The axiomatic quality of those validated principles which represent such solutions to paradoxes of the ontological type, is not a collection of principles existing in parallel to one another. As in the attempt to locate our position of the moment in terms of all the motions within the universe which must be considered to define a normalized position, the axiomatic principles of a valid experimental physics are always what

15. I merely identify, without elaboration here, the crucial fact of the history of modern scientific method, that the successive work of Kepler's and Leibniz's development of a calculus based upon a principle of absolute non-linearity of physical processes in the infinitesimally small—itself a key principle of a science of physical economy today, led into Carl Gauss's and Bernhard Riemann's development of what is otherwise known by the alternate titles of "hypergeometry" or "multiply-connected manifolds." The root of these discoveries in modern scientific method is to be traced directly from Cusa's attention to the deeper implications of the notion of circular action.