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An economic theory compatible with life processes and physical laws[1]

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An economic theory that is consistent with life processes and physical laws is necessary for a simple reason: the economic theory that underlies modern "mainstream" economics and practically all textbook teaching in economics is *not* consistent with life processes and physical laws. And this is a problem.

Human beings are living organisms. All human activities, including mental activities, are consistent with physical laws. It is natural to build an economic theory on the foundation of biology and physics. In my forthcoming book with Jing Chen, *Entropy Economics,* we undertake this task, for two foundational elements of economics: the theories of value and production.

Modern mainstream economics is a theory of balance, or equilibrium. The basic terms of reference are the concepts of supply and demand, which interact in a market and come to rest at certain prices and quantities. There are a thousand different ways in which this process may be disturbed, by "imperfections" and "shocks." But at the heart of the matter lie the concepts of balance and equilibrium – the immanent order toward which a market system is supposed to tend. This immanent order is sometimes called a "steady state." This is a very comforting idea, compatible with such notions as the "end of history" and the triumph of market capitalism over competing social systems.

In real life, there is no such thing. In real life, time moves from the past, through the present, to the future, in an unceasing process of change. The changes take many forms, including birth, growth, decline, death, and the rise and fall of societies and civilizations. All of them occur under the influence of physical and biological laws, including especially the second law of thermodynamics and the laws of biological evolution. In our view, economics should adhere to the same broad principles. It should not rest on the illusion of an underlying steady state.

In modern mainstream economics, there are two separate and distinct institutions or arenas for action. One is the market; the other is the government. These two arenas have separate functions: the market allocates resources according to the preferences of households and business firms; the government enforces contracts and property rights and provides security and protection. Apart from that, government economic activity is described as "intervention" in the market, which is sometimes justified, but often not.

In real life, there are no markets (of any consequence) without governments to regulate them. Regulation creates the conditions under which complex economic activities can occur, and it sets the

[1] Adapted from the preface to *Entropy Economics* by James Galbraith and Jing Chen, forthcoming from Chicago University Press. The book will contain a full exposition of the theories and supporting mathematics.

terms and limits of economic competition. Regulation has the same function in economics that it does in every mechanical and biological system: it keeps (or tries to keep) the flow of resources within the capacity of the system to handle it safely and sustainably. When regulation fails, markets crumble – or to use the apt metaphor, they "melt down."

The theories of value and production are the foundations of economic theory. Both should be consistent with life processes and physical laws.

From physics, entropy flow is the fundamental driving force of the universe. It is natural to imagine that entropy somehow forms the basis of economic value. (Georgescu-Roegen, 1971). And indeed, an entropy theory of value is a scarcity theory, very familiar in the history of economic thought. Value is a function of scarcity, which is, in part, a matter of product availability relative to market size. It is also, in part, a function of number of producers or service providers. This too is very familiar in the history of economic thought. In practice, the most important method to enhance valuation is to reduce the number of providers, creating monopoly or oligopoly.

Governments enjoy many forms of monopoly, including over legalized violence, judicial punishments, and taxation. Governments grant monopolies, through patents, intellectual property rights, regulation, and industry standards. Businesses seek monopoly, through technological innovation and market dominance, sometime legal and sometimes not. Unions seek monopolies in bargaining – also called countervailing power – to help workers enjoy some of the fruits of their employers' monopoly power[2]. The phenomenon extends beyond economics: monotheistic religions hold monopolies to reach heaven, giving them power to prescribe codes of conduct.

Once acquired, monopoly power is naturally guarded. The ruling class generally adopts the policy of "divide and rule". From its point of view, monopoly power is something *not* to be shared. The ruling class therefore often divides the ruled by race, ethnicity, religion, culture, and other criteria, and encourages small groups to define themselves as distinctive and separate from their fellow-citizens. Similarly, businesses often prefer to stratify their employees by credentials and occupational categories and to negotiate with them (if at all) one-on-one rather than face an organized union. This division lowers the value of voters in a democracy and the power of workers in a contract dispute -- making them easier to rule. Monopoly is for the powerful; competition is for the weak.

If a sub-group grows too large or too strong, so that it threatens the monopoly position of the ruling class, one solution is to split it up into smaller entities, at war with each other. Another solution is to suppress the upstart group altogether. This pattern plays out often on the world stage, and at every scale in the organization of human affairs, from the family to the nation-state. A realistic theory of value should take account of how value is created and maintained through the exercise of monopoly power.

For most goods, therefore, economic valuation depends both on the abundance or rarity of the product (in relation to the market) *and* on the number of suppliers with the ability to produce and access to the market. However, the role of monopoly is modified, in most societies, by social decisions – regulations – that govern economic conduct, including the prices of most types of human labor and the rate of interest. Monopoly power at the level of the business or oligarch is rarely absolute; it would not be tolerable if it were. Or to put the matter in evolutionary terms, societies that do not limit monopoly power are generally unstable and do not last for very long.

[2] These phenomena were analyzed in Galbraith (1952), Galbraith *fils* (1998), and by Ahmari (2023).

A key regulatory function is control of inequality: inequality is necessary, but it is dangerous if becomes too great. Economic inequality motivates activity: economic agents compare themselves to others and strive to improve their position – to make more money, to grow their wealth. Without this incentive, human societies would be much harder to organize and sustain. But too much inequality is like an overheated engine or a person with rising blood pressure. It is a sign of discontent, of trouble ahead, and a warning of potential breakdown.

Mathematically, the entropy theory of value is very simple. It is given by a logarithm function, in which the argument is a measure of market scarcity, and the base is given by the number of suppliers. Some may call this superficial. But such a simple theory can describe the value of monopoly and oligopoly, among the most important phenomena in the economic and social world. It can also help us understand the integration of markets and regulation that is an indispensable feature of all organized economic life. These are qualities the prevailing mainstream theory does not have.

Value applies to goods and services that are produced. Economic activities are mostly about the production of goods and services. Consumption may be the ultimate goal of economic activity, but without production there is nothing to consume. For production to occur, economic decision-makers, such as business firms and governments, must make the decisions to produce. A production theory should explain those decisions.

Conventional economics, such as you find in textbooks, usually doesn't start with production. It usually starts with exchange, with trade. The goods to be exchanged already exist. Where did they come from? Who created them? Why and how? This is usually left to a later chapter. And when production makes an appearance, the theory describing it usually looks a lot like the exchange theory. The difference is that instead of a consumer choosing between eggs and butter, the theory now describes a firm choosing various combinations of labor and capital.

Currently, in theoretical economics, production theory is mainly built around the concept of a production function. In the theory represented by these functions, there is no *decision* to produce. The decision is assumed; production always occurs to the maximum feasible extent; resources (including labor) are not left unemployed. At both the micro- and the macroeconomic levels, the production function is a parable of cooperation between capital and labor in the production of goods and services. It also provides the basis of a theory of wages and profits, relating each to the contribution they make to total output. Production functions thus work to rationalize and therefore to justify market processes and market distributions. They associate the high incomes of some people with their productivity, which is very comforting to those people.

In real life, production comes before exchange. Production is the concentration of resources into finished products. Exchange is the diffusion of those products to those who use them up. For production, regulation is generally essential, though it is often unpopular with those experiencing it. For exchange, regulation is somewhat less essential – though it is often desired to ensure that the process of exchange is fair to all parties. Production therefore happens in organizations; exchange generally happens in markets. A production theory is a theory of the role of organization in economic life.

A production theory based on biophysical principles bears a close resemblance to the production issues faced by actual businesses (and other economic decisionmakers, including households and government planners) in the real world. It should cover the major factors affecting such decisions, including fixed cost, variable cost, duration of production, discount rate, expected return, uncertainty, and, of course, the final output of goods or services. It should spell out with precision the relationships

between these factors. If so, it can provide a realistic understanding of economic (as well as social and biological) phenomena, when compared with the mainstream or neoclassical theory of production.

A biophysical theory of economic production has (as the name suggests) many parallels with life processes. Indeed, economic systems can be understood as extensions of our understanding of life processes, and the physical realities that underpin them. Here, a key fact is that all activity – physical, biological, economic – requires access to and the use of resources. But despite the obvious importance of physical resources, mainstream social theories, including economic theories, often pay little attention to them. Indeed, our standard measures of economic activity, the national income accounting which underpins our concept of Gross Domestic Product, treats all market-based activities as equivalent in dollar terms. And according to that accounting, industries like mining, energy production and agriculture are just a small part of our economic activities -- practically negligible, in value terms.

Why is that? Perhaps it has something to do with the way people who design theories like to look at the world – and at their own place in the world.

Long ago, George Orwell asked a similar question about coal and physical work. In his 1937 book, *The Road to Wigan Pier*, he concluded,

> Practically everything we do, from eating an ice to crossing the Atlantic, and from baking a loaf to writing a novel, involves the use of coal, directly or indirectly. … But most of the time, of course, we should prefer to forget that they were doing it. It is so with all types of manual work; it keeps us alive, and we are oblivious of its existence.
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> It is only because miners sweat their guts out that superior persons can remain superior. … all of us really owe the comparative decency of our lives to poor drudges underground, blackened to the eyes, with their throats full of coal dust, driving their shovels forward with arms and belly muscles of steel. (Orwell 1937, 31)

If we acknowledge the essential role of (let's say) coal (or oil, or gas, or water power) in our life, we can no longer ignore the harsh life of essential workers, the coal miners and farmers and other frontline workers, who bring basic resources and food to our homes But if we recognize them for the essential role that they play and improve their working conditions and pay, many of the rest of us will no more afford as many of the luxuries of modern life that we now enjoy. It was convenient for superior persons to ignore the essential role of coal in the past, and it remains convenient to ignore that of many other essential workers today.

A biophysical theory of value explains the very small weight of natural resources in our measures of economic activity – they are ubiquitous and essential, but they are abundant and cheap. More accurately, they have been abundant and cheap until now. But this has not always been the case, and several centuries of resource abundance may be coming to an end soon. What then? Conventional mainstream theories are not worried; they assume that new resources can be substituted for the old ones, that technologies will adjust, and life will continue as it has. At the very worst, in mainstream theory, the producers of key resources will become wealthier, and others will be less wealthy, as part of the ordinary process of market adjustment.

A biophysical theory undermines this optimistic view. It draws a critical distinction between fixed and variable costs. Fixed costs, set by past investment, determine and limit the options for current, viable production. Variable costs are governed, to a large extent, by the cost and quality of resources. If

those costs rise, or resource quality declines, then a given production technology can become unprofitable, and production using that technology will decline or cease. Indeed, fixed cost is a kind of leverage in the production process. The more reliant production is on large prior fixed investments, the less flexibility there is, and the more vulnerable are production decisions to increases in the cost of resources.

A socially-approved theory provides much needed illusion. Truth, or dis-illusion, will get people disillusioned. That is why most mainstream social theories are built on illusion. Formerly, approved social theories were mostly based on the favor of gods. These are religions. With the increasing power and prestige of science, many social theories began to call themselves scientific, such as scientific socialism. Later, social theories became “social sciences”. But this does not mean the purpose of social sciences is to seek truth or to dispel illusions.

In an age of social conformity and the dominance of mainstream economic ideas, ideas that are politically and socially correct will tend to dominate a society. This is convenient for those who profit from the prevailing climate. But – as a biophysical principle -- maintaining a state of untruth is costly. If the lies, illusions, and misconceptions become too obvious, people will resist them. In that case, it will take a greater and greater effort to brainwash, harass, and even persecute the resisting public. Anyone who has ever taught introductory mainstream economics – or ever taken such a class – has seen this phenomenon in miniature.

If the burden of enforcing a false vision on a society grows too great, the public will tend, at best, to tune out – even to rebel. This is a potent danger to the survival of society itself. To take an easy example from the “other side” of the world, the decline and fall of the Soviet Union can be attributed, in part, to the fact that no-one could any longer believe in the promises of the Soviet Communist Party. This is a lesson that should be applied generally – including to our own social system.

For this reason, seemingly esoteric matters of economic theory can take on a larger importance. We must choose between accepting a viewpoint that is socially convenient but unreal and useless, or attempting to rethink premises and to draw realistic – if sometimes harsh -- conclusions. The first course is much easier, but in the long run, much more dangerous. And there is always the risk, since societies do compete in the world, that if our own does not embrace reality, some other society, with more courage and determination and clearer minds, may beat us to it.

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