

# Biophysical Economics and the Failed Growth Economy

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## ABSTRACT

The traditions of both mainstream and ecological economics presuppose the inherent nature of a market economy is to grow. However the traditions of classical and modern political economy posit an economy that is subject to limits to growth and one that tends towards secular stagnation. This paper explores the stagnation thesis in the contexts of the current financial crisis, political impasse and the limits posed by the potential conjuncture in time of peak oil and climate change.

## INTRODUCTION

The standard model of neoclassical economics posits a self-contained and self-regulating economy. This approach is embodied in the familiar circular flow of materials, factors and money. In contrast, ecological economics embraces a pre-analytical vision of an open and growing economy embedded within a finite and non-growing biophysical system. The economic subsystem must obey the laws of the primary system as regards the flow of energy, and its growth is necessarily limited by the primary system. Moreover, the resilience of natural systems depends upon certain redundancies and biodiversity to function properly in their own rights. This further limits human ability to appropriate the whole of net primary productivity for economic uses.

A great deal of excellent work has been accomplished by economists and ecologists in the past fifteen years estimating how big the economy may grow relative to the limits of the supporting biophysical systems. In the 1980s and 1990s a number of studies focused upon the carrying capacity of the planet (Vitousek, *et al.* 1986, Daily and Ehrlich, 1992, Postel, 1984, Rees and Wackernagel, 1992), while others sought to improve the accuracy of the income and product accounts as regards assessing the impact of humanity upon the finite and non-growing biophysical system (Daly and Cobb 1989, Cobb and Cobb 1994, Costanza, *et al.* 1997).

Unfortunately less work has been done assessing the nature of the economy, its inner dynamics, and how it operates as a system. The idea of the growing economy is so taken for granted that few ecological economic analyses have been devoted to understanding formally the patterns of growth, the or structural and institutional changes over time. The uncritical acceptance of growth may actually hinder a broader and more comprehensive understanding of mature market economy as a system. We are witnessing just the latest in a long series of such economic declines. I believe it is crucial to understand the dynamics and limits to the economic system if we are to more fully understand the interaction between the economic and biophysical systems.

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The study of political economy is comprised of just this focus on the dynamics of accumulation, distribution and institutional change. The purpose of this paper is to begin the process of integrating the principles and insights of political economy and institutional economics into the corpus of biophysical and ecological economics.

## THE NATURE OF LIMITS

I assert that the growth of a mature industrially-based economy located within a democratic political system is constrained by three sets of limits. To begin with there is a set of *biophysical limits* imposed by the laws of the finite and non-growing primary system in the age of hydrocarbons. These limits take the form of a declining resource base, for example peak oil, and the accumulation of heat trapping gases in the atmosphere. In addition the economy faces a set of *internal limits* posed by the inability to find sufficient spending outlets for the growing economic surplus in the real economy. This is most commonly recognized by Keynesian economists as the problem of inadequate effective demand. Cost reductions accomplished by means of technological change, increased productivity and efficiency must find comparable outlets in rising aggregate demand if they are to result in profitability rather than chronic unemployment and excess capacity. Finally the final impediment to fundamental change is a set of *political limits*. Bills are fashioned to pass the legislative bodies rather than to solve the problems at hand, and arcane rules perpetuate the *status quo*. When long-term strategies for growth succumb to internal or biophysical limits they do not immediately give way to superior strategies. Instead the nation often becomes mired in a period of political impasse. No one perspective is sufficiently strong to impose its vision, yet at the same time is strong enough to keep another vision from being implemented. The twentieth century was dominated by periods of impasse. The accepted vision of the self-regulating economy was dashed by the severity of the great depression, and after nearly half a decade a new vision emerged in the form of the New Deal in the United States. Keynes' theoretical insights would not come until the seventh year of the depression, and were never fully implemented.

This vision of a managed economy and a positive state survived until the limits of effectiveness were reached in the early 1970s. The liberal growth agenda, driven by increasing household incomes, could not survive the peak of US oil production, the decline of US political power internationally, and the onset of stagflation. A long period of impasses followed, only broken in the early 1980s with the election of Ronald Reagan to the presidency and the implementation of a conservative growth agenda grounded in the reduction of production costs and the expansion of unregulated financial markets. We are currently witnessing another such period of political impasse. Our current economic and political systems depend on growth; however there is simply no way one can grow their way into a smaller impact on the planet. Attempts to decarbonize the economy in the face of globally peaking oil will reorder fundamentally the power relations of American industry and finance, as well as create myriad macroeconomic dislocations as well. As much as our economic and political structures depend upon growth, the scientific evidence of limits to growth is overwhelming.

The result of the historical conjuncture of these limits results in *The Failed Growth Economy*: an economy that *must* produce growth in order to provide for profits and employment yet at the same time simply *cannot* produce this requisite growth. Since the 1970s in the United States the failed growth economy creates a fundamental dilemma. **Growth rates of the real economy have not been sufficiently high to provide for full employment, while at the same time aggregate growth has been too high to provide for sustainability within finite and non-growing biophysical limits.** We grow too much and too little at the same time.

Historically these periods of economic crisis and political impasse were transcended by transforming nature to meet human needs. In other words society could push back the biophysical limits in order to transcend the political and economic limits. We are most probably entering a historically unprecedented era, one for which no models exist. As we approach the era of globally peaking oil and the limits posed by atmospheric carbon dioxide we may no longer have the ability to ignore the consequences of reaching biophysical limits. Instead we must learn to live within these limits: to draw our energy from renewable solar flow rather than limited terrestrial stocks subject to depletion. We must maximize human welfare while simultaneously reducing the flow of matter and energy through a finite and non-growing system. In short we must cease growing. But how to accomplish that, without perpetuating the worst aspects of the failed growth economy: unemployment and lack of opportunity, is a difficult endeavor. It must begin with an understanding of the dynamics of the growth economy itself.

## **GROWTH AND ACCUMULATION IN CLASSICAL POLITICAL ECONOMY**

Classical Political economists from Adam Smith to John Stuart Mill shared common threads. They all subscribed, in one form or another, to cost of production theories of value. Moreover, all of them focused on the process of accumulation, and all theories accounted for the end of accumulation and the arrival of the *stationary state*. For Smith the problem began with the division of labor. In rude and early societies a person's own labor could supply the bulk of his or her needs. But the introduction of the division of labor entails producing to fulfill the needs of others, which necessitates an accumulation of capital. The need for accumulation expands with the division of labor. An expanding market is necessary to absorb the output created by increased productivity. Virtuous individuals refrain from current consumption and use the savings to accumulate stock, thereby setting productive labor into action. By doing so, the private pursuit of profit is translated into public virtue. However Smith's vision also entails the end of accumulation. The increase in stock inevitably leads to a decrease in profits. The resulting decrease in profits leads to a secular reduction in investment and the onset of the stationary state.

The debates of years following the death of Smith (in 1790) earned economics the name "the dismal science." Thomas Robert Malthus, starting from the position that a fraction of the poorer classes will inevitably starve, warned that increasing the incomes of the poor would simply increase the demand for food and thereby drive up its price. Throughout the subsequent six editions of the *Essay on the Principles*

*of Population* Malthus extended this vision to argue that the prospects for growth would be limited by the growth of human population, unless somehow “checked” by measures that would either lower the birthrate, or alternate measures that would increase the death rate. What Malthus also took as given was the existing set of restrictions on imported food (the “Corn Laws”) that ensured both higher food prices and a steady source of income in the form of rent for the landed gentry and aristocracy. These were restrictions he favored, as they increased rents relative to profits. Not only was Malthus a conservative spokesperson for landed interests, his theory of accumulation was grounded in the politics and economics of effective demand and a critique of Say’s Law of Markets. Income that was not claimed as rent would accrue to capitalists who would save an inordinate share. These hordes of savings would reduce the overall demand and create the potential for a stagnant economy. Malthus’ solution was the maintenance of the “Corn Laws” and the expenditure of the subsequent rents upon unproductive labor that did not add to the productive potential of the economy.

Opposing Malthus was David Ricardo, who argued for a repeal of the Corn Laws. Here Ricardo argued that since the most fertile land was used first an extension of domestic cultivation into parcels of inferior quality would produce both decreasing output per unit of input and increasing rents. Both rising costs and rising rents would squeeze profits. Eventually, as the margin of cultivation was extended, all of the social net product would be divided between wages and rents. But before the onset of this logical conclusion when profits fell below the rate of interest (Ricardo estimated 6-7%), capitalists would channel their funds into speculative pursuits. Consequently accumulation in the real economy would grind to a halt.

Ricardo argued that the elimination of the Corn Laws could postpone the onset of the stationary state. If cheap imported grains replaced those grown by the extension of British cultivation the onset of diminishing returns could be postponed. The resulting increase in profits would be reinvested expanding both the number of productive workers and their productivity. From Ricardo modern economics takes not only the principle of diminishing marginal returns but also the faith that these diminishing returns can be transcended by free trade and technological change.

The most unique approach to the stationary state among the Classical Political Economists was that of John Stuart Mill. Mill believed the onset of the stationary state was imminent, postponed only by government borrowing, capital export and waste. Furthermore, the end of the era of growth could be accompanied by a greater focus on improving the human condition by means of the combination of income redistribution and zero population growth. Once population growth among laborers ceased the pressure on the growth of capital formation to provide employment would be lessened and a superior society could ensue.

## **NEOCLASSICAL AND KEYNESIAN ECONOMICS**

Notions of the stationary state came to a halt with the Jevonian Revolution and the rise of subjective utility theory. Not only were the determinates of price dematerialized and attributed to the final degree of

subjective utility, but the calculus of constrained optimization was adapted to quantify this subjective approach as science. The focus on accumulation was supplanted by static and comparative static determinants of price formation, and the tendency for the system to produce a stable equilibrium. All social policies and internal contradictions disappeared into the formalization of the self-regulating circular flow of material and money and the reassertion and mathematical formalization of Say's Law (Mirowski 1989). Adjustments in prices alone could equilibrate quantities in all markets, and efficient allocation by means of prices became the holy grail of economics--all in a world of certainty.

It was these propositions that Keynes opposed in his *General Theory of Employment, Interest and Money*. Keynes left the fundamentals of subjective theories of value and distribution in tact. His critiques focused on macroeconomic aggregates rather than price formation in individual markets. He focused one critique upon the labor market where he was primarily interested in refuting the idea that movements in relative prices would suffice to equilibrate output at a full employment level. Instead Keynes argued that wages comprised the major component of effective demand, and that a reduction in wages would reduce the capacity to consume the output.

It was in the area of savings and investment that Keynes made his biggest mark, arguing that changes in the relevant price, the interest rate, would not serve to equilibrate the market for loanable funds. Instead Keynes posited that savings depended upon the level of income. Investment was more complicated, as it depended not only upon the cost of acquiring funds, but also upon profit expectations. Profit expectations themselves depended upon animal spirits as well as income and the cost of capital. But these spirits themselves were fraught with uncertainty. It was simply impossible to predict the performance of finance markets over the lifetime of an investment. Moreover, liquidity preference became highly elastic at low interest rates, and a liquidity trap could reduce the effectiveness of monetary policy. Keynes put most of his faith and effort into governmental stimulation of investment. Investment was linked to the other component of final demand, namely consumption, through the marginal propensities to save and consume and by the multiplier. Keynes' theory of the causes of, and solutions to, the depression were squarely in the lineage of other underconsumption theories. This held out the possibility of effective demand would be chronic rather than acute, raising the need for long-term full-employment policy not simply short-term "pump priming." Theoretically, Keynes raised the possibility of secular stagnation, although he did not develop the details. Neither did he render his system dynamic. That task was left to his followers (Dobb 1973).

## **THE STAGNATION THESIS AND THE EMERGENCE OF MODERN GROWTH THEORY**

An emphasis on economic growth emerged only in the latter stages of the New Deal. The early new Deal was about rescuing a failed growth economy and a collapsing financial sector within the confines of Franklin Roosevelt's fiscal orthodoxy. Spending programs were matched by a tax increase. FDR's commitment to a balanced budget did not free sufficient funds to "spend one's way out of the depression."

It was only during the Second World War, the largest public works program the United States has ever seen, that the needs of the emergency caused political leaders to put aside their fears of budget deficits. But during the second depression of the great depression (1937-39) the American Keynesian Alvin Hansen re-enunciated a theory of secular stagnation. Hansen argued that adequate investment outlays are needed to sustain full employment and adequate income levels. However these investment outlets are difficult to find in a mature economy. Mature economies exhibit slower rates of population growth, and population was the driving force behind investments in residential building, territorial expansion, and the expansion of railroads and public utilities. The 19<sup>th</sup> century gave birth to the industrial revolution with the use of fossil fuels to power machinery and the corresponding increase in investments in plant and equipment. Then came a period of “readjustment and relative stagnation” (Hansen 1938: 314). This period of stagnation was followed by the great expenditures of the railroad age, which themselves reached saturation. This was followed by the ages of electrification and the automobile which provided a whole host of opportunities for investment in related industries as well.

Hansen predicted that new innovations to come would use far less capital per unit of output. After adjusting for new products and processes, as well as technological change, Hansen concluded that new opportunities sufficient to fully utilize the flow of savings would be difficult to find in the mature economy. Hence the dilemma was one of secular stagnation and the stability of the system, rather than a short-term imbalance of supply and demand. He advocated that the government become essentially an investment banker rather than simply a lender of last resort or a short-term pump primer.

Hansen’s argument was supplemented in the late 1940s by the work of Evesy Domar in the “golden age” of growth theory. In 1947, fresh on the passage of the Employment Act of 1946 by congress (mandating the three goals of reasonably full employment, stable prices, and economic growth) In “Expansion and Employment” he posited that the percentage of the labor force employed depends upon the ratio of national income and productive capacity. His key insight was to point out what he called “the dual nature of investment.” Investment creates income and employment, while simultaneously creating productive capacity that must be utilized to maintain employment. After formalizing the role of investment in the creation of national income, Domar turned to the determinants of investment.

$$(1) \quad Y = \Delta I \frac{1}{\alpha} \quad \text{where } 1/\alpha \text{ is the multiplier, and } I \text{ is Investment. Furthermore:}$$

$$(2) \quad \Delta I \frac{1}{\alpha} = I\sigma \quad \text{where } \sigma \text{ represents the potential social average productivity of investment as a measure of the change in productive capacity.}$$

The left hand side of the equation stands for the annual incremental change in income (the demand side or the multiplier side) while the right hand side represents the annual increase in productive capacity (the supply or productive capacity side.) The dual nature of investment shows as investment appears on both sides of the equation. In other words investment generates an increase in income through a

multiplier effect but also generates an increase in productive capacity that must be employed. If income and employment are to rise a growing level of expenditures must be targeted towards investment. **The increase in income is not a function of the level of investment but of its rate of change.** This is the essence of the failed growth economy. Investment cannot grow forever at an increasing rate because of its role in augmenting productive capacity. At some point excess capacity appears and new investment is no longer profitable (Domar 1947).

The degree to which excess capacity affects investment depends upon the structure of industry. A competitive economy that is changing rapidly in terms of technology shows little positive correlation between capacity utilization and new investment. However unused capacity presents a serious threat to new investment in industries that are monopolized. Insufficient investment today creates unemployment today. If more is invested today even a greater amount will be needed tomorrow to maintain full employment. It is likely that the increase in income will more than compensate for the increase in capacity. However the increase in income is temporary while the increase in capacity is longer lived. If the dreaded stationary state is to be avoided humanity must arrive at a greater understanding of the relation between technical progress and spending patterns.

### **THE STAGNATION THESIS SYNTHESIZED**

In 1966 Paul Baran and Paul Sweezy published *Monopoly Capital* in 1966 and enunciated the most complete modern statement of what has come to be called "the stagnation thesis." They began their essay with the proposition that the economy had become dominated by the giant corporation. Technically Baran and Sweezy analyze an economy dominated by oligopolies

They then linked the rise of oligopoly with the decline of price competition. Oligopolies compete corespectively, to use Schumpeter's term, by means of cutting costs and increasing market share, not by means of reducing prices. The new method of competition widened the difference between the value of the output and the cost of producing it, which Baran and Sweezy defined as economic surplus. They hypothesized that the fundamental economic problem in the era of monopoly capitalism is the inability to absorb, or find adequate spending outlets for, the rising economic surplus. This rising surplus leaves its statistical trace as excess capacity and unemployment. Baran and Sweezy then go on to explain the internal mechanisms by which surplus can be absorbed. Surplus can be invested, but here they utilize Domar's theory of the dual nature of investment, and the greater impact of excess capacity upon new investment in a monopolized economy. In the end private investment alone proves inadequate to the task of fully absorbing surplus. Surplus can be consumed, but even with the development of the sales effort in the 1950s-from planned obsolescence to the explosion of advertising consumption cannot adequately absorb a rising surplus either. The ability of civilian government to consume adequately the surplus is constrained by the political process. The final option is to simply waste the surplus. Baran and Sweezy focused mainly on the military but in today's climate one must also consider our fossil fuel-based

transportation system, our approach to health care and its resulting enormous production of medical supplies and waste, and our crumbling yet expensive system of public schools. In the end the internal mechanisms are incapable of sustaining the absorption of economic surplus. In their sense of the term stagnation does not mean lack of production. Rather the macroeconomy generates actual income levels that are beneath potential income levels. This results in chronic excess capacity and unemployment. Consequently: **The natural tendency of a mature, monopoly capitalist economy is towards stagnation, not growth.**

The theoretical task then becomes one of explaining occasional periods of economic growth, not periodic downturns. This they do by relying on Hansen's and Joseph Schumpeter's notions of the *epoch-making innovation*. Such innovations not only absorb tremendous amounts of investment capital themselves but fundamentally transform the structure of industry by creating myriad ancillary industries to absorb more investment capital themselves. They utilize the three innovations cited in Hansen (1938): the steam engine; the railroad; and the automobile. From a biophysical point of view all these innovations transformed the structure of industry and society by requiring, and stimulating the search for, cheap fossil energy. The automobile helped create the demand for suburban housing, drive-ins, repair shops, the interstate highway system, and influenced the popular music, not to mention the sexual freedom, of the 1960s absorbing sufficient economic surplus to provide for a prolonged period of prosperity. The rise of the automobile utterly transformed the oil industry. The second factor that absorbed sufficient surplus was *war and its aftermath*. The Second World War was the largest public works program in American history. Unemployment, which stood at 17.9% in 1939, fell to 1% by 1944. The aftermath of the war led to the Bretton Woods Accords, the Marshall Plan and a long period of U.S. hegemony. The end of this hegemony, along with the collapse of the Bretton Woods Accords in the 1970 signaled a period of economic transformation.

## **THE RISE OF THE FINANCIAL ECONOMY**

Throughout the 1980s Paul Sweezy and Harry Magdoff began to raise consistently questions of finance relative to production in the real economy. Moreover they treat the rise to prominence of the financial economy as a symptom of the overall secular stagnation of the real economy. Instead of being a parasitical usurper of funds that would naturally lead to productivity increases when invested in productive capacity, Magdoff and Sweezy assert that the rise of the financial services sector has been the primary means by which the stagnation of the real economy has been kept at bay. In addition they assert that the financial system has not simply grown, but has fundamentally transformed the economy. In traditional theory banks play the role of a benign vehicle by which the deposits of households and firms are transferred to investors by means of loans. Banking was reasonably safe, reasonably profitable, and downright boring. In the transformed state, termed "Monopoly Finance Capitalism" the expanded, and increasingly independent, financial services sector has come to claim the dominant share of the systems

profits, increase the offering of increasingly complex securities, and has become the nation's largest debt-holding sector. The financial sector exists to create ever more complex derivative securities in order to seek out potential opportunities for growth and profit, as well as reducing systemic risk. However, the rise of the financial economy is subject to its own limits, and in the end cannot overcome the inherent stagnationist tendency of mature capitalism. Limits are, once again, those internal to the investment process, biophysical, and political.

As the real economy has stagnated, financial activity and the expansion of debt have come to represent a growing share of total profits and a rising percent of the components of income. Moreover capacity utilization has fallen. It will help to recall that profit-making strategies in the monopoly capitalist era include cost reduction and the expansion of market share. But cost reduction has entailed the reduction in wage growth, as well as the reduction of materials cost. But how does one sell more output to a population with declining incomes? The answer is to be found in the expansion of debt. But at some point the limited income will also limit the expansion of debt, as will the rising inequality in the distribution of those incomes. This was manifest, over the course of the last year, especially in the housing sector. What productivity increases as have occurred in manufacturing have largely been the result of utilizing increasing quantities of cheap oil. (Cleveland, 1984)The advent of peak oil will raise these input prices with two potentially adverse results. On the supply side rising oil prices (and consequently rising prices for food, chemicals, transportation, etc) will eventually lead to the reemergence of cost-push inflation. It is very difficult to fight cost-push inflation by means of contractionary monetary policy, as interest charges are themselves components of costs. To the degree that oligopolies price by means of marking up prime costs, tight money can actually feed cost push inflation rather than remediate it (Wachtel and Adelsheim 1977). Furthermore, oil is denominated in dollars and any structural weakening of the U.S. economy, say by means of cost-push inflation, can further exacerbate the increase in oil prices.

However, the increase in oil prices can have demand-side effects as well. As oil prices increase the petrodollar stocks found in sovereign wealth funds will need to find outlets. If the country follows an accommodating monetary policy, these funds will look for higher rates of returns than can be found in Treasury Bonds. Either the giant global pool of money insatiably seeks out riskier but higher returns, for example mortgage backed securities and collateralized debt obligations or moves the money to financial systems promising higher rates of return on their securities (e.g. Iceland with its 11.5% rate of return). When these funds began to exit Iceland during the financial panic the country itself was near bankruptcy. So the coming of peak oil may have the same type of dual effect that Domar posed as a problem as regards investment. If a country adapts an easy money policy the risk of system-wide financial collapse increases as does the marketing of increasing quantities of lower quality securities spreads. If the nation runs a contractionary monetary policy the risk of stagflation becomes more manifest.

Climate change presents an entirely different set of biophysical limits. In absolute terms real per-capital GDP has increased, nearly exponentially since the middle of the 20<sup>th</sup> century. So too, has consumption, with the general exponential trend increasing despite the recurring recessions of this time

period. It is this increase in consumption, bigger cars, more gasoline, and more energy-intensive appliances that drives the increase in carbon emissions and carbon dioxide concentrations in the atmosphere. James Hansen of NASA Goddard Space Center, perhaps the nation's most prominent scientific voice concerning climate change estimates that the theoretical "tipping point" at which irreversible damage will occur at concentrations of 350 parts per million. The "Business as Usual" strategy may produce atmospheric CO<sub>2</sub> concentrations in the range of 1200-1400 ppm by 2100. The Intergovernmental Panel on Climate Change uses these data to predict a sea-level increase in the range of 18-59 centimeters, with a very likely of increase heat waves and heaving rains. In addition they predict the likely increase of droughts, tropical cyclones, and extreme high tides. If we already exceed the tipping point by nearly 30 parts per million and data-based projections indicate possible CO<sub>2</sub> concentrations that are four times the tipping point by the end of the century the indication is that we **simply cannot grow our way into environmental sustainability**. Unless you simply discount the validity of the scientific evidence, or believe we can instantaneously convert to a carbon free source of energy without fundamentally disrupting financial markets then climate change appears as an external limit to the potential for economic growth. Moreover, the advent of peak oil may likely occur in the same time frame (from now until mid-century) as do the impacts of climate change. In essence the next generation will have both problems to deal with at the same time with, as we shall see, little discretionary income with which to deal.

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