The Age of Declining Returns

Mauro Bonaiuti Univ. Of Turin, Italian Degrowth Association

Abstract

This paper examines the hypothesis that - roughly speaking from the mid-1970s- advanced capitalist societies entered a phase of declining marginal returns (DMR) (Illich, 1972, Tainter, 1988).

The DMR process involves both social and biophysical systems. Therefore some tools of the theory of complex systems (feedback, emergence, scale) - along with some historical evidence- will be introduced. This will facilitate the necessary trans-disciplinary analysis.

The central part of the paper presents some empirical evidence of this general dynamic. Indicators concerning agriculture (Fulginiti and Perrin, 1997), energy (Hall, Powers, and Schoenberg, 2008), mineral extraction (Bardi and Pagani (2007), and research and health systems (Tainter, 2006) are analysed. We also see how the principle of declining marginal returns emerges from the very heart of the capitalist system itself, that is to say from the process of technological *innovation* (Strumsky, Lobo and Tainter, 2010).

In this new DMR framework, some of the fundamental problems that have characterised advanced capitalist economies over the last forty years - can be reinterpreted and better explained. These problems include: the precarious condition of labour; the widespread explosion of public debt; the crisis of the welfare state, which in some led to the collapse of whole nations. (Soviet Union, Iceland, Greece).

Moreover the principle of diminishing returns allows us to read the current crisis from an evolutionary perspective. From this some future scenarios can be developed. Our main conclusion is that advanced capitalist societies are entering a *Great Transition* (Bonaiuti, 2014) toward new institutional orders. In order to facilitate the transition toward a desirable scenario, some political dilemmas are considered.

Introduction

The proposal for a degrowth society has so far mainly been based on what Max Weber called a "statement of value". This is an essential part of the degrowth proposal. However, the society of "frugal abundance" proposed by the growth objectors is still seen by many as just "wishful thinking" in the sense that it is destined, like all attempts at change relying mainly on moral precepts, to remain the initiative of a minority.

Although derided by common sense, ignored by the media and opposed by the dominant institutions, degrowth is gaining attention in the public arena. Why?

It is basically due to the permanence of some processes, forcing public and

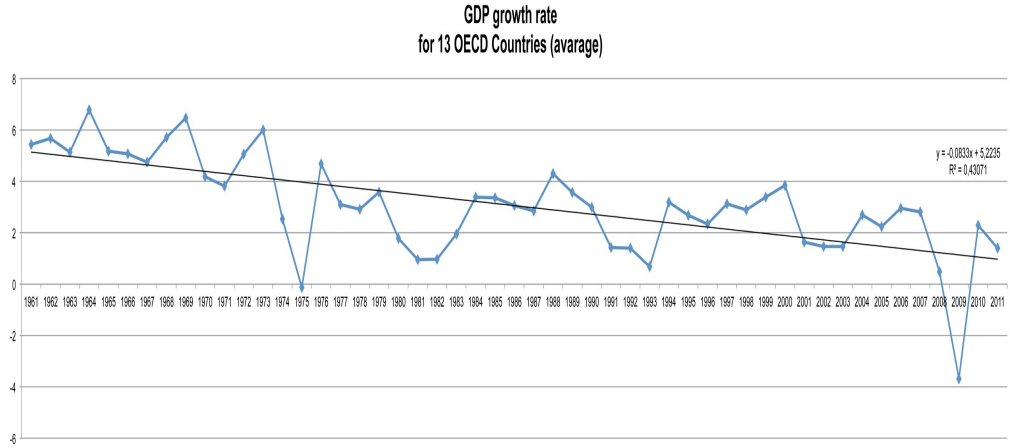
policy makers to take into account what they would gladly do without. In other words, when social organisations face new problems, they try to solve them through a process of complexification and differentiation of their structures. But, beyond a certain threshold, the marginal benefits this process involves decrease, while costs (in the broadest sense) inevitably increase.

DMR seems to be affecting some of the most important complex organizations sustaining today's capitalist economies. Before embarking on a detailed analysis, we need to, however, briefly consider this process from an historical point of view.

Something Has Changed

Despite crises and involutions, which in some cases were dramatic, particularly in the two decades between the wars (Polanyi 1944), growth and expansion were the processes that characterised the nineteenth century and the first half of the twentieth. Once again, after the Second World War and, growth recommenced at an even faster rate, giving rise to what has been defined by historians as a "golden age", a phase of stable, accelerated growth that changed the world probably more than any other period in history of a similar time-span (Hobsbawm 1992). However, from about the mid-1970s, something seems to have changed in the "long waves" of the evolution of advanced capitalist countries. Economic growth has continued, but at a slower rate than in the golden age. Similarly, increases in productivity have also slowed down.

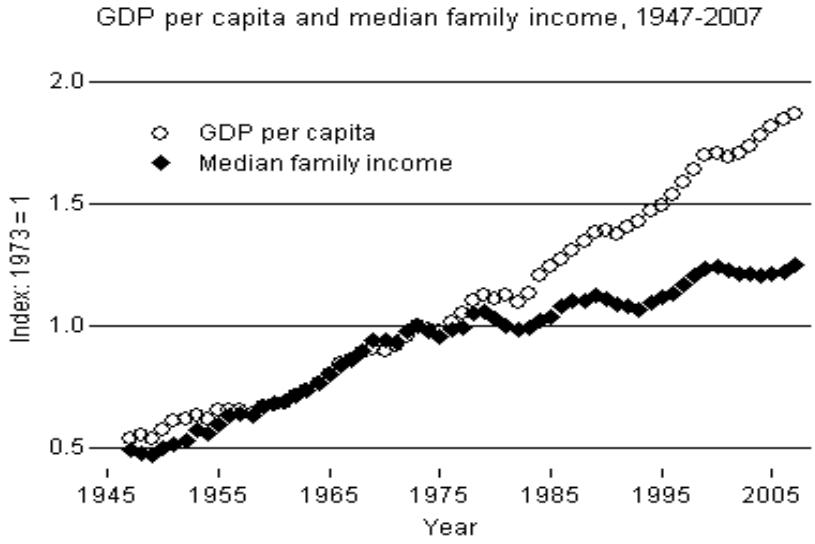
The figure below shows the trend in growth rates in OECD countries from the 1960s.



As we can see, the growth rates have, on average, gradually fallen and seem to tend

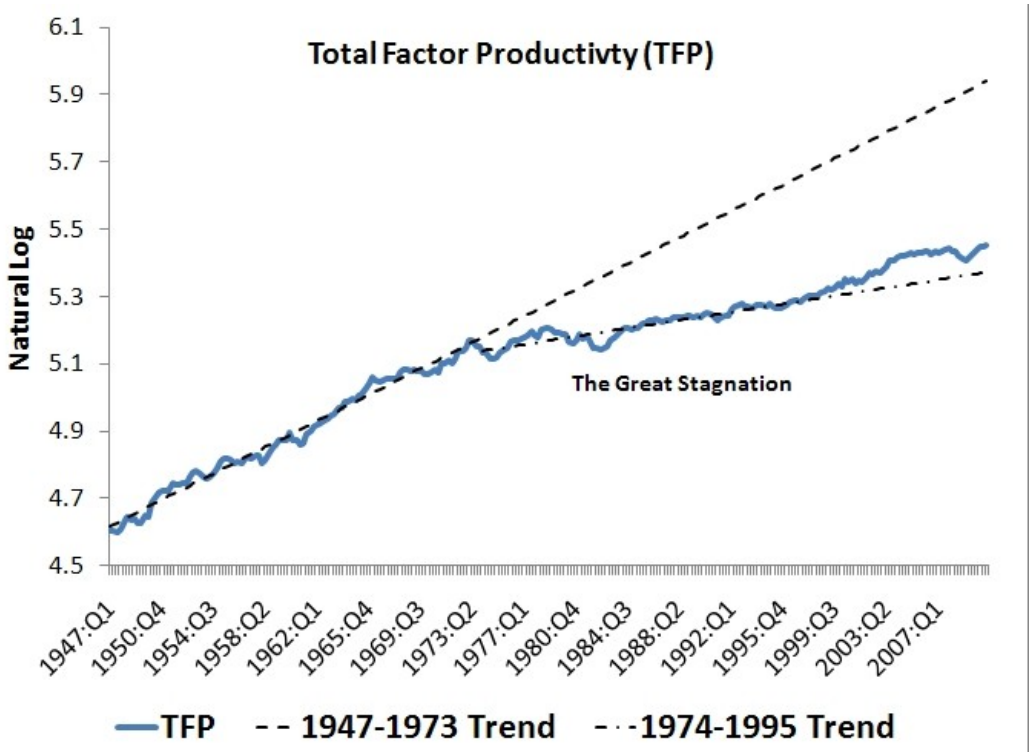
asymptotically towards zero: for most western economies, they are already less than 2% today. Since the data refer to a period of about fifty years, in no way can we interpret them as a short-term cyclical trend or attribute them to the undoubtedly serious consequences of the crisis we are now witnessing.

Let us now consider the median incomes of American families from the end of the Second World War to the crisis of 2007. Median incomes are probably a better indication than GDP, as the economist Tyler Cowen maintains, of long-term effects on families' well-being.



As we can clearly see, while (median) incomes from 1947 to 1973 more than doubled, from 1973 to 2004, that is a longer period, they grew by only 22% (Cowen 2011, 15). The tendency to slow down is evident.

Finally, let us consider some of the long-term data concerning the total factor productivity (TFP). Although the TFP is a controversial indicator of technological progress, it is enough to offer the idea that we wish to emphasise here, that is to say that something has changed in the dynamics of the capitalist system. Roughly speaking from the mid-1970s, advanced capitalist countries, such as the USA, seem to have entered a phase of relative decline, or more precisely of *Declining Marginal Returns* (henceforth DMR).



The concept of DMR was introduced by Joseph Tainter (1988), an archaeologist and expert on complexity, in an important study on the collapse of complex societies. The basic idea that Tainter maintains is that once a certain threshold has been reached in the growth of the complexity of the structures that make up a society, the benefits of any further increases in complexity diminish. As we can see, in Tainter's approach it is the increasing complexity of organisations that beyond a certain threshold gives rise to declining returns.[1] Along with the reduction in benefits, declining returns generally involve an increase in the various types of "costs", which are also to be taken in the widest, not merely economic, sense.

While not excluding references to the world today, Tainter's analysis does not specifically refer to advanced capitalist societies. He considers rather some important historical cases, showing how advancing DMR may lead, and in some cases actually did lead, to the collapse of a certain social organization. The main aim of the following sections will be to argue that the hypothesis that advanced capitalist societies have

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However, since economic growth generally involves an increase in the complexity of various types of economic and social structures, the concept of DMR can also be indirectly linked to GDP growth.

entered a phase of declining marginal returns is quite plausible, despite the fact that official sources make no mention of this, and that, indeed, there is much evidence to support this theory. Needless to say, in sustaining our theory we shall be obliged to speak in very general terms, albeit with reference to some specific organisations, in the hope of arousing some interest that may lead to further, deeper enquiry and research.

The idea behind the DMR principle, which Tainter picks up, is not new. In the economic field, David Ricardo had already noticed at the beginning of the nineteenth century that as agricultural production gradually becomes more and more extensive, reaching terrains that are more and more marginal, hence less fertile, so productivity decreases. In later times, even marginalist economists had noticed that if the number of workers on a plant is increased beyond a certain threshold, the amount of the product that can be obtained from any extra worker added inevitably decreases. It seems that in general this phenomenon can be applied extraordinarily well both to different types of input (capital, labour, raw materials) and to the various types of productive processes (agricultural, industrial, services), so much so that it is called the "law" of diminishing marginal returns, a truly extraordinary case as far as economic science is concerned.

Although it is accepted by neoclassical economists and applied in the mainstream theory of growth (à la Solow), the law of declining marginal returns has not led economists, as we know, to the pessimistic conclusions implicit in Ricardo's interpretation: according to the neoclassical approach, decline in marginal productivity concerns the short term, that is to say that phase when the capital (plants) is considered fixed. In the long run, technological progress permits the function of production to shift continually upwards, thus compensating for declining returns. We shall return to this point below.

From what has been said, one should not, however, assume that declining returns are a phenomenon of a mainly economic nature: the phenomena described by the principle of declining returns should be taken as just one of the possible manifestations of a more general process.

As will become evident, the principle of DMR has to do rather with the fact, typical of complex systems, that any progressive differentiation in structure comes up against the "internal limitations" within the organisation itself. It has, thus, more to do with the idea of "counterproductivity" presented by Ivan Illich in the 1970s, when he picked up the seminal contributions made by some biologists and naturalists in the period between the two world wars.[2]

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[2] Illich himself recognises that there is a fundamental intuition underlying his whole criticism of institutions, and this intuition concerns the relationship between *growth* and *form*. He acknowledges his debt to natural scientists such as J.B.S. Haldane and D'Arcy Thomson, as far as this basic intuition is concerned. In actual fact, in his vision of the imminent collapse of industrial civilisation, foreseen in the last chapter of *Tools for Conviviality* (1973), Illich may have confused the passage through the first

In order to defend our hypothesis, we shall first present some considerations of a general nature, which will permit us to clarify the concept of DMR, and then present some focal issues concerning specific sectors and complex organisations that reveal declining returns (agriculture, the energy and mineral extraction sector, the educational, research and health systems and the industrial sector). Finally, we shall see how the principle of DMR emerges from the transformations that marked the transition from the Fordist system to that of "flexible accumulation" and, furthermore, how this permits us to understand better the transformations that have characterised the labour market, welfare and the dynamics of public debt in recent decades. The "financialisation" of the economy, the crisis in National States (particularly the collapse of the Soviet empire) and, finally, the establishment of the "capitalism of disasters" will also be analysed in this perspective.

To begin with, there is a "structural" explanation that clarifies why declining returns arise in a process once a certain threshold has been crossed. It is connected to the mathematical relationship that ties stock to its relative flow. We can illustrate this concept with examples taken from both biology and social sciences. Let us take the case of a small economy that has recently begun its own process of industrialisation. Its capital stock is necessarily limited and consequently so is the flow of products that this stock is able to generate. In these conditions (on the left of the figure, that is, with C below C_1), it is not surprising that the growth rate may be very high. Thus, for example, Equatorial New Guinea, a very recently industrialised country, grew by 387 % from 2000 to 2010, while Germany or Japan both grew less than 9%. Since New Guinea started out with extremely low values, an increase of 300% in ten years is not so extraordinary.

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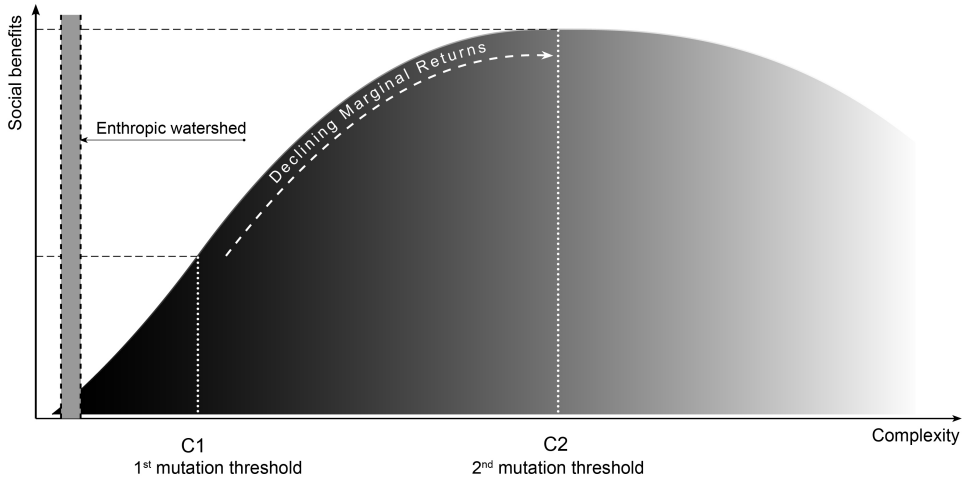
threshold of mutation (which in our hypothesis was taking place in those years) with the passage through the second threshold .

D.M.R. AND MUTATION THRESHOLDS



On the contrary, when an organization is already very large, it becomes relatively more difficult to grow further. In this case, even a zero growth rate means that the capital stock must in any case sustain a considerable productive flow in absolute terms. This helps us to understand that the phenomenon described is general: when in the initial phases the stocks involved are still low, high growth rates are normal, and when, on the contrary, the stocks involved are very high, the growth rates diminish. Trends of this type (S-shaped cycles) are hence very common both in biophysical and in social systems.

Declining Marginal Returns in Agriculture

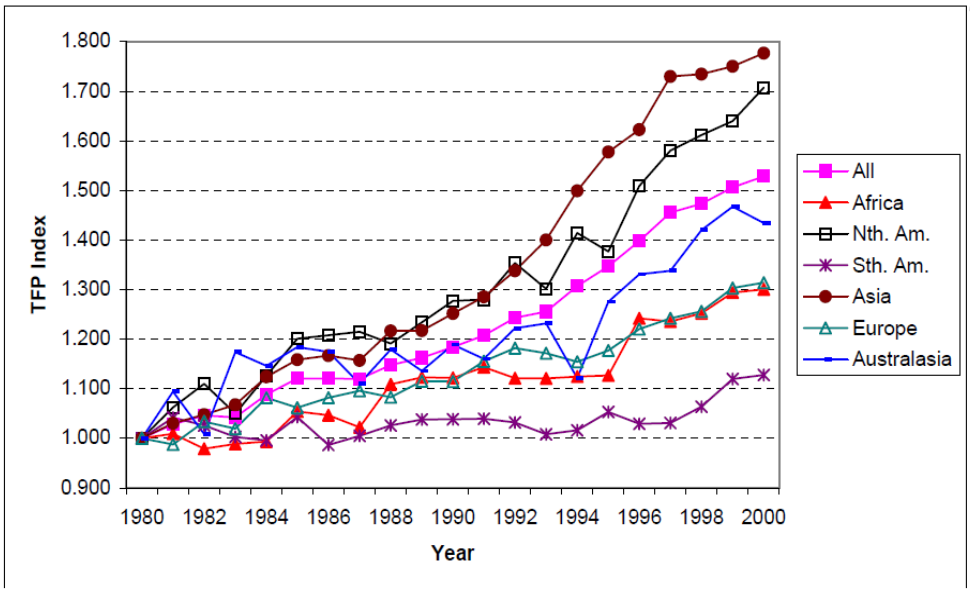
We shall first focus on the evolution of agriculture in the pre-industrial age. Joseph Tainter (1988) reports a classification of the typical use of the land in that period from the economist Ester Boserup (1965):

1. *Forest-fallow cultivation.* It is a system whereby trees in parts of a forest are felled and cultivation replaces them for a certain number of years. As yields gradually diminish, the plots are abandoned and return to forests for about 25 years.
2. *Bush-fallow cultivation.* Similar to the above but the periods of non-cultivation

are shorter, of about six to ten years.

3. *Short-fallow cultivation*. In this case the land is left uncultivated for only one or two years.
4. *Annual cropping*. In this system a fallow period of some months is left between harvests.
5. *Multi-cropping*. This is the most intensive system considered by Boserup, and it foresees the rotation of crops on the same land. It can be carried out only in a few highly favourable regions where the seasons are not too extreme

Figure 2 Cumulative TFP Indices



The first interesting observation is that when moving towards the most intensive typologies in the use of labour (from type 1 to type 5), while the overall production increases, the productivity of labour decreases. In other words, as the number of farm-hands and the intensity of the agricultural process increase, so the amount of food per head that is effectively obtained decreases. Boserup's conclusions seem to be confirmed by more recent studies: in the north of Greece, for example, labour applied at a rate of 200 hours per hectare is fifteen times more productive than labour applied at 2,000 hours per hectare (Clark & Haswell, 1966; Wilkinson 1973).

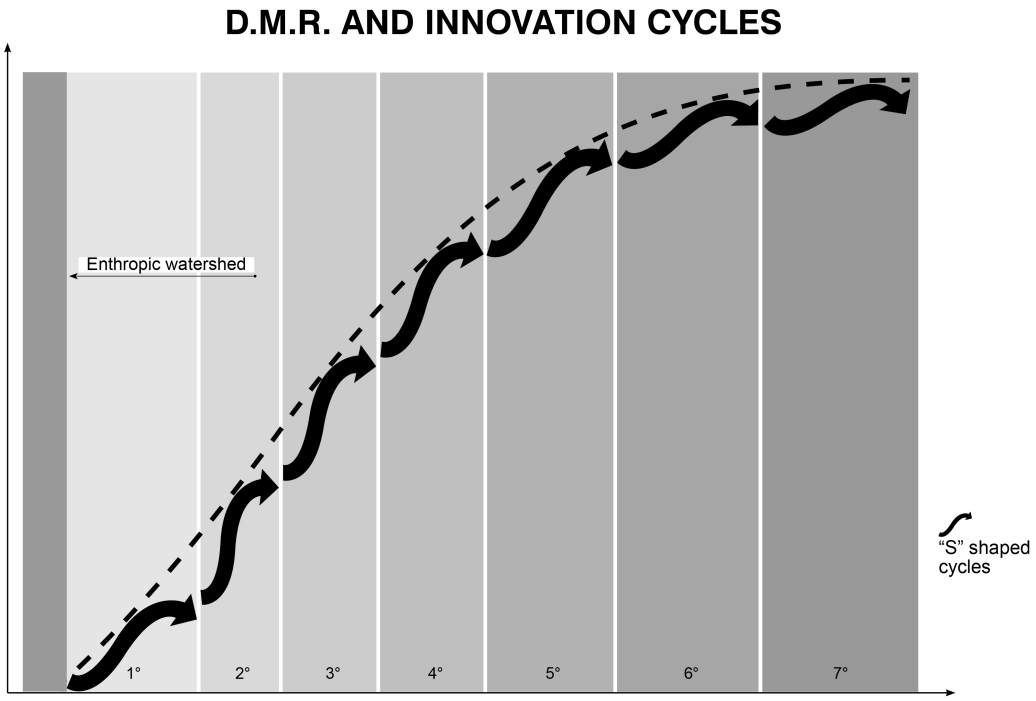
If, on the one hand, this fact throws a great deal of light on farmers' century-old resistance to innovation[3], on the other, it may explain the tendency towards underproduction, as observed by several anthropologists, in economic contexts

[3] What remains to be explained, in this context, is what the driving force towards new methods of more intensive cultivation (in terms of labour) was if it was met with hostility on the part of the farmhands. According to Boserup, the answer is to be sought in the pressure exerted by the growing population.

characterised by subsistence agriculture with decreasing (labour) returns.[4]

"Posposil noticed that the Kapauku Papuans of New Guinea, for example, work only two hours per day in agriculture. Robert Carnero found that Kuikuru men in the Amazon Basin dedicate two hours a day to agricultural work and 90 minutes fishing. The reminder of the day is spent in social activities or at rest. With a little extra effort, these peoples could produce much more than they do. [...] But they valued leisure more highly than the marginal return from extra labour" (Tainter 2006, 94; Sahlins 1972).

The most important consideration for us is that the declining returns observed in pre-industrial agricultural contexts do not only concern the single productive technology but can also be noticed in the overall sequence of the various technological innovations, as we can see in Figure 5.



It is obvious that the advent of the "green revolution", with the widespread employment

[4] In this perspective, the attention paid by theorists of degrowth to underproductive economies (Illich 1973; Latouche 1996) does not arise merely from ethical or political considerations (they are fairer and more autonomous). There are also economic reasons: in an age of DMR, in fact, higher levels of production are frequently accompanied by lower wages.

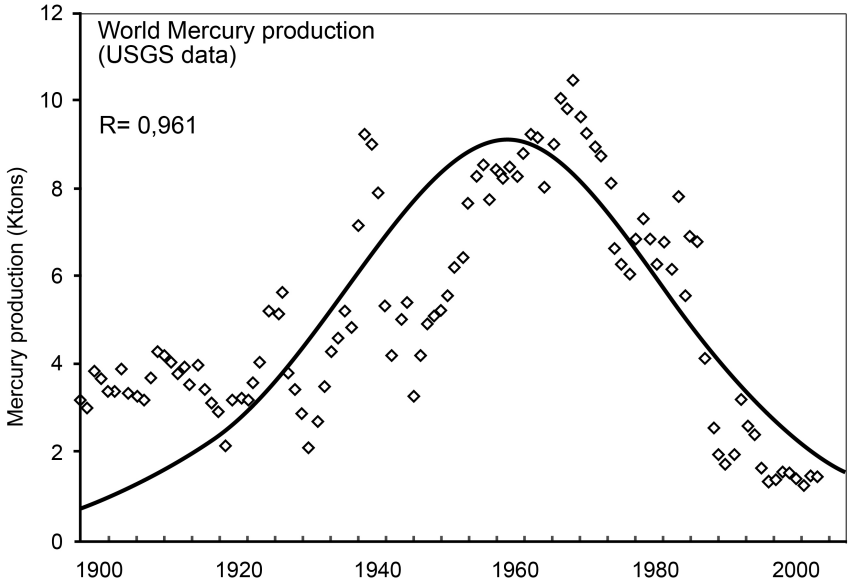
of fossil fuels, signified a true and proper leap in scale of productivity in agriculture. Surpassing the new entropic watershed gave rise to a new phase of increasing returns, according to a trend similar to that shown in Figure 4. Yet after this initial phase, modern agriculture also entered its own phase of DMR. Figure 3.6 shoes data on Total Factor Productivity from 1980 to 2000 in 93 countries (Coelli and Rao, 2003). The trend clearly reveal a slowing down of TFP growth at least from the '90. Most Less Developed Countries, in particular in South America and Africa, show a stagnation or even a decline in the productivity of agriculture already in the period 1961-85 (Fulginiti and Perrin, 1997).

Mineral and Energy Resources

As far as the extraction of minerals is concerned, the fact that those deposits that present a higher concentration are used before those of a lower concentration is obvious; hence the marginal productivity of these sources tends to diminish in time (and the cost of extraction increase). Human beings today extract at least 10 thousand million tons a year of matter from the Earth's crust, more than ten times as much as that extracted from plants. Furthermore, while the biosphere uses only 27 elements, humans extract and use all the elements found in the crust (Bardi 2013). Some of these elements are fairly abundant and are defined as "common" (concentrations of more than 0.1% in weight). Of these, five are metals important for technological purposes: iron, aluminium, magnesium, silicon and titanium. All the others are found in smaller concentrations. Most of these are found in the Earth's crust in concentrations of under 0.01% and are thus defined as rare (among which copper, zinc and lead). Finally, others such as gold, platinum and rhodium are very rare and are found in the crust in well under a millionth part.

According to Bardi and Pagani (2007), of all the elements present in the crust, eleven have reached the peak of production and are on the decline. It seems, therefore, that the same typical bell shaped curve that we shall see for oil, gas and carbon, is also valid for minerals. The case of mercury is shown below in Figure 3.7.

MERCURY PEAK



Source: Bardi and Pagani, 2007

Needless to say, the magnitude of the peak does not depend solely on the relative availability of the given element and its concentration but also on the quantity of energy available for its extraction. The Roman silver mines reached their maximum production before they were abandoned: of course, maximum production at that time was connected to the types of extraction techniques and to the energy then available. The declining trends in productivity in the extraction of minerals are thus closely tied to those of energy.

In this regard, we have today an indicator capable of showing precisely the declining returns of energy. This is EROEI (*Energy Return on Energy Invested*) that measures, as we know, the relationship between the energy rendered by a particular source throughout its entire life-span (LCA) and the energy required to construct, maintain and in the end dismantle plants. Calculations are, therefore, not simple and they differ, at times significantly, according to the methods of measurement; however, it cannot be denied that there has been a considerable drop in the energy returns of the fossil fuels on which the whole industrial economy is based. As far as crude oil is concerned, the fall goes from an EROEI of about 100 in 1930 to about 25 in the 1970s and to today's 10-20. Natural gas also has an EROEI of around 20 today (Hall, Powers, and Schoenberg, 2008).

year	oil	coal
1930	100	80
1970	30	30
2005	10-18	-

In conclusion, as we can see in the Figure, the energy obtained from fossil fuels has clearly for a long time been following a course of DMR.

It may, furthermore, be of interest to compare the EROEI values of fossil fuels with the values of renewable sources of energy: the latter now present EROEI values that are similar to, or in some cases better, than those of traditional sources, from 5-15 of small-scale windpower to 12-15 of silicon photovoltaic and 30-40 of cadmium telluride photovoltaic. Although it is still questionable as to whether photovoltaic energy may be a "Promethean technology", in the sense in which we have defined it, there can be no doubt that the progress made in recent years has been truly considerable: an EROEI value of 30-40 is highly respectable and could hardly have been imagined at the time when Georgescu-Roegen was writing.[5]

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[5] Georgescu-Roegen strongly insisted on the fact that solar technology, unfortunately, was not a Promethean technology since (at the time, i.e. at the end of the 1970s) it was not yet capable of producing enough energy to reconstruuct its own material structure and generate a surplus (EROEI > 1). Considerable progress has been made in this field although it is not yet clear whether solar technologies will be able to sustain a further leap in scale in social complexity compared to the present state.

These data are also important if we wish to estimate the speed at which fossil fuels can be replaced by renewable sources of energy: a photovoltaic plant of the latest generation is capable of providing enough energy to reconstruct a new plant in about a year. Despite this potential and the exponential growth in recent decades, substitution of conventional sources with renewable ones is extremely slow. Without strong incentives, renewable sources are on the whole more expensive: this is clear if we think that these technologies have still only reached at present a modest quota (about 0.1% of the total energy produced in the world for photovoltaic and windpower), thus requiring high investment costs, while conventional sources have generally already amortized their investment costs and offer high returns.

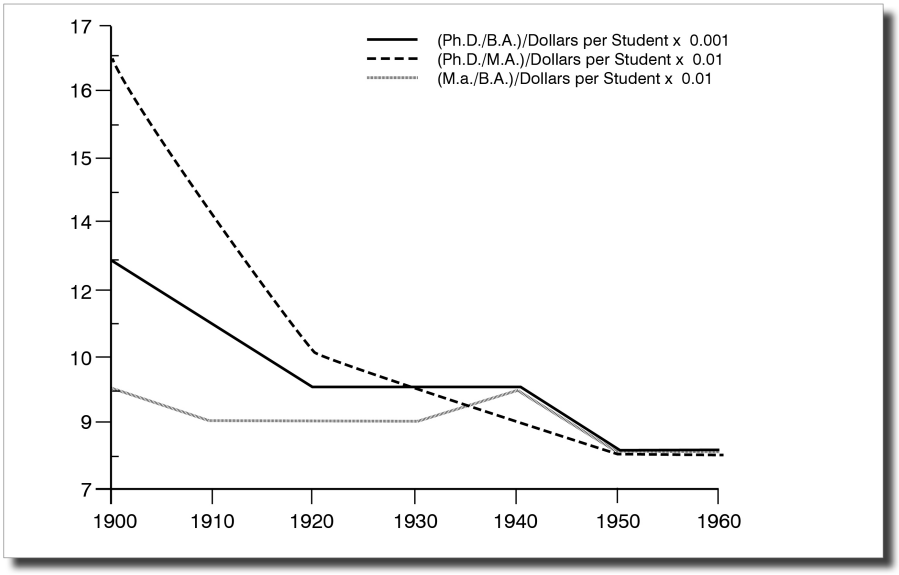
According to the most recent research, replacing fossil fuels with renewable sources within the time period calculated for the peak of the former, while technically possible, does not seem to be making progress fast enough. This is basically because this progress comes into conflict with strong, well-established interests. In other words, it would require economic agents that are at least "weakly" self-interested, that is willing to invest in projects that render less (in the long term) than traditional ones, and/or considerable public investment.

In conclusion, the long-term challenge seems to remain open. Be that as it may, in the next few decades, until renewable sources reach significant percentages of energy production, the productive system will be forced to undergo the declining returns of conventional sources that we have described.

DMR in Services: Education, Research and Development, Health

Complex systems, besides employing matter and energy, make use of increasing amounts of knowledge. However, knowledge also has its costs, and even "dematerialised" systems present declining returns, once a certain threshold has been reached. Here, too, every time a new problem arises, the organisation makes a further differentiation and becomes more complex, so managerial costs increase, leading to declining productivity. At the same time, as Ivan Illich clearly saw, organisations tend to produce disutility in the broader (biophysical and social) system in which they operate. These negative external effects take on very different forms and, in time, they tend to accumulate and compromise the efficiency of the organisation.

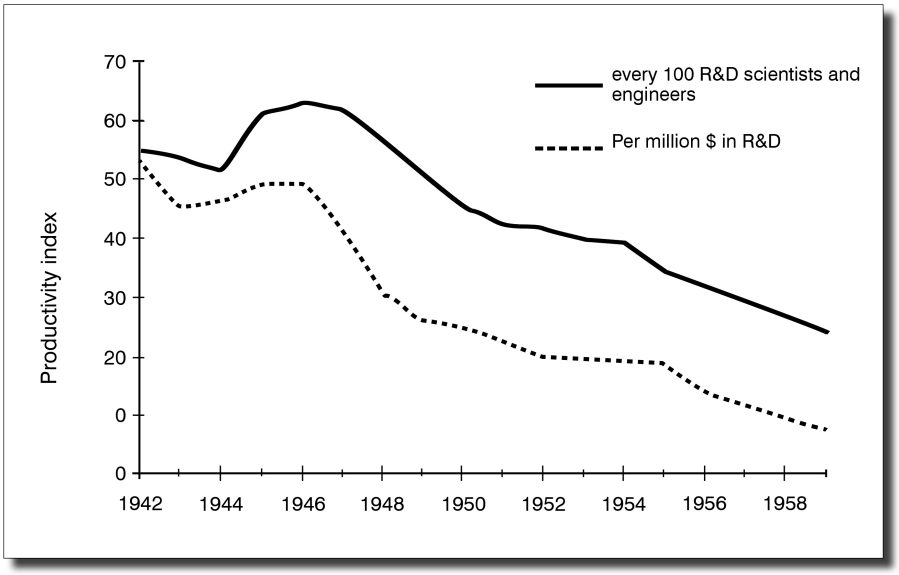
Productivity of US Educational System 1900-1960



Source: J. A. Tainter, Social complexity and sustainability, 2006

Joseph Tainter (2006) reports an exhaustive study on the costs of education in the United States (Machlup 1962): in the period 1957-58 the cost of kindergartens was about $ 886,000 a year for each school age (from 1 to 5 years of age). The costs of primary and secondary schools rose to about $ 2,565,000,000 a year for each school year (from the age of 6 to age 18). For those who aspired to higher education (less than 35% of the population), university courses cost the country about $ 3,190,000,000 a year (also per age group). Hence the cost of education from pre-school level, when more general knowledge is acquired, to college, where the system of learning is more specialised, increases by 1,075% per student. In conclusion, from 1900 to 1960, data reveals a reduction in the productivity of education, hence following a course of declining returns. It is very likely that if we had data referring to the period after 1970, we would see that productivity fell even further.

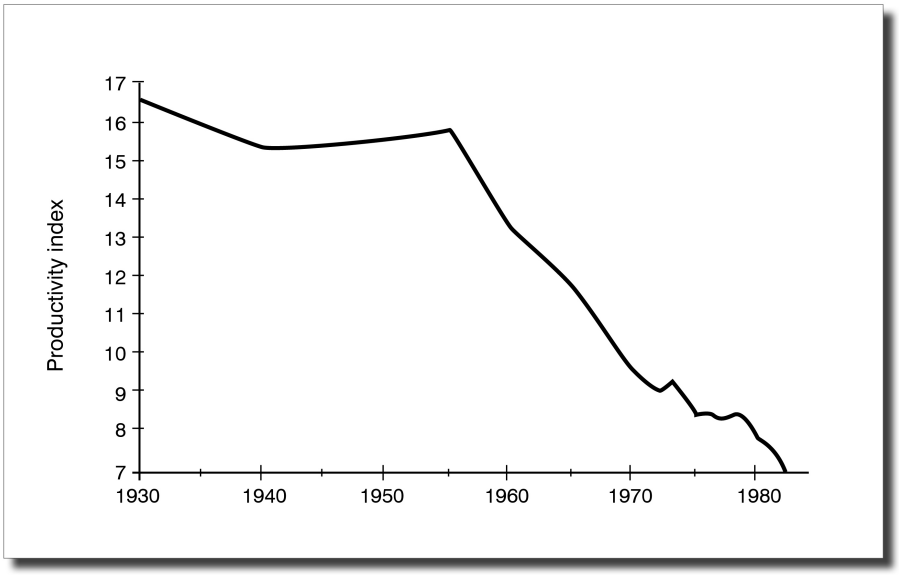
R&D productivity in USA 1942-1958



Source: J. A. Tainter, Social complexity and sustainability, 2006

Scientific research is undoubtedly the showpiece of man's ability to solve problems. The early conquests in the scientific field were unquestionably very generic and thus the benefits from the results obtained were such that the costs seemed insignificant. However, as research gradually becomes more specialised, its marginal benefits tend to diminish and its costs increase. From some estimations of the productivity from investments in scientific research (Figure 3.10) it can be seen that this, too, reveals declining returns. These types of research use patents as an indication of the productivity of the research: this is obviously a controversial way of evaluating productivity, but in some fields, such as medicine, where it is easier to estimate the productivity of the research, results confirm these trends. "In the 52-year period," (shown in figure 3.11) "from 1930 to 1982, the productivity of the American health system in improving life expectancy fell by about 60%. Medical productivity is falling because the least expensive remedies were discovered first: the basic research that led to the discovery of penicillin, for example, did not cost more than $ 20,000" (Tainter 2006, 95).

Productivity in US Health Care System 1030-1980



Source: J. A. Tainter, Social complexity and sustainability, 2006

Economists' Objections and DMR in the Industrial Sector

The DMR principle is also recognised in economic texts, where it is presented both as a principle of declining marginal productivity (in the standard theory of growth à la Solow) and as the theory of the "product life-cycle" (at a microeconomic level**)**. In the latter version, the idea is that in the initial phases of the "introduction" of an innovative product onto the market, it will develop at increasing rates and, once it has reached its "mature" phase, will continue to expand but at declining rates, until it reaches a maximum that precedes its being dropped or replaced by a new product with new characteristics.

Therefore, as the very theory of the product life-cycle suggests, the process of DMR exists even in the industrial sector. However, since innovation moves increasingly more rapidly, and innovation is orientated by the market towards greater efficiency, economists conclude from this that continual innovation will be able, now and in the future, to free us of declining returns.

This “Promethean” interpretation of the role of innovation, which has by now become common belief, undoubtedly captures a very significant point, but, at the same time, veils another equally important one.

The blind spot in economists’ analyses is that, as we have seen, innovations are not all the same. In the continual creative recombination that give rise to new cycles of expansion, the new process does not start out again, in actual fact, from the same “initial” conditions. Surpassing the entropic watershed made new sources of low-cost energy available (coal, oil) which, employed in the factory system (electrification), thanks also to mass schooling, ensured increases in productivity that can hardly be repeated (low-hanging fruits). In the USA this “long wave” of values of Total Factor Productivity (TFP), already surged in the Twenties, reaching a peak after the Second World War, to then drop drastically with the end of the golden age. For example in the communication sector TFP fell from 4.62 (in 1948-1966) to 2.84 (in 1966-1973), Public Utilities from 4.79 to 1.24 and Construction from 2.46 to -3.10 (Field 2007).

Not even the ICT revolution has been able to turn this trend around significantly (Cowen, 2010). By integrating successive cycles of innovation, we shall thus obtain – also for the returns of industrial production - a sort of “big s”, which starts with the industrial revolution, presents a point of inflexion roughly in the ‘70s and tends towards a horizontal asymptote, as we saw in Fig. 4. These conclusions undoubtedly require further research, since it is extremely difficult to evaluate the evolution of the “benefits of industrial production” given the continual qualitative transformations that it involves, above all in a such a long time-span (over a century). However, the hypothesis of a “Great Stagnation” in the industrial sector does not lack empirical evidence and theoretical foundation.

If, as Schumpeter already observed (1942), the true essence of capitalism lies in this continual innovation, where a new idea, technology, or organisational form gives birth to a new enterprise, or a new industrial sector, we must not forget that the counterpart to this is the destruction of other (old) products, organisational forms, jobs or enterprises that cannot adapt or are not advanced enough to capture this new opportunity.

This process of *creative destruction* evidently bears a (negative) entropic balance in the long run, along with increasing social costs. We thus see how, beyond a certain threshold, the process of transformation that lies at the very heart of capitalist dynamics (the innovation process), may present diminishing returns. Yet again, everything depends, in the evaluation of the relationship between costs and benefits, on the breadth of our view, in other words on the confines of the “system” of reference. If the confines of the system are sufficiently broad, the DMR process will clearly emerge, since normally the increases in efficiency associated with technological progress are often nothing but the outcome of substitutions or transferences of costs to other subsystems, which, in lacking a market price, are simply not taken into consideration.

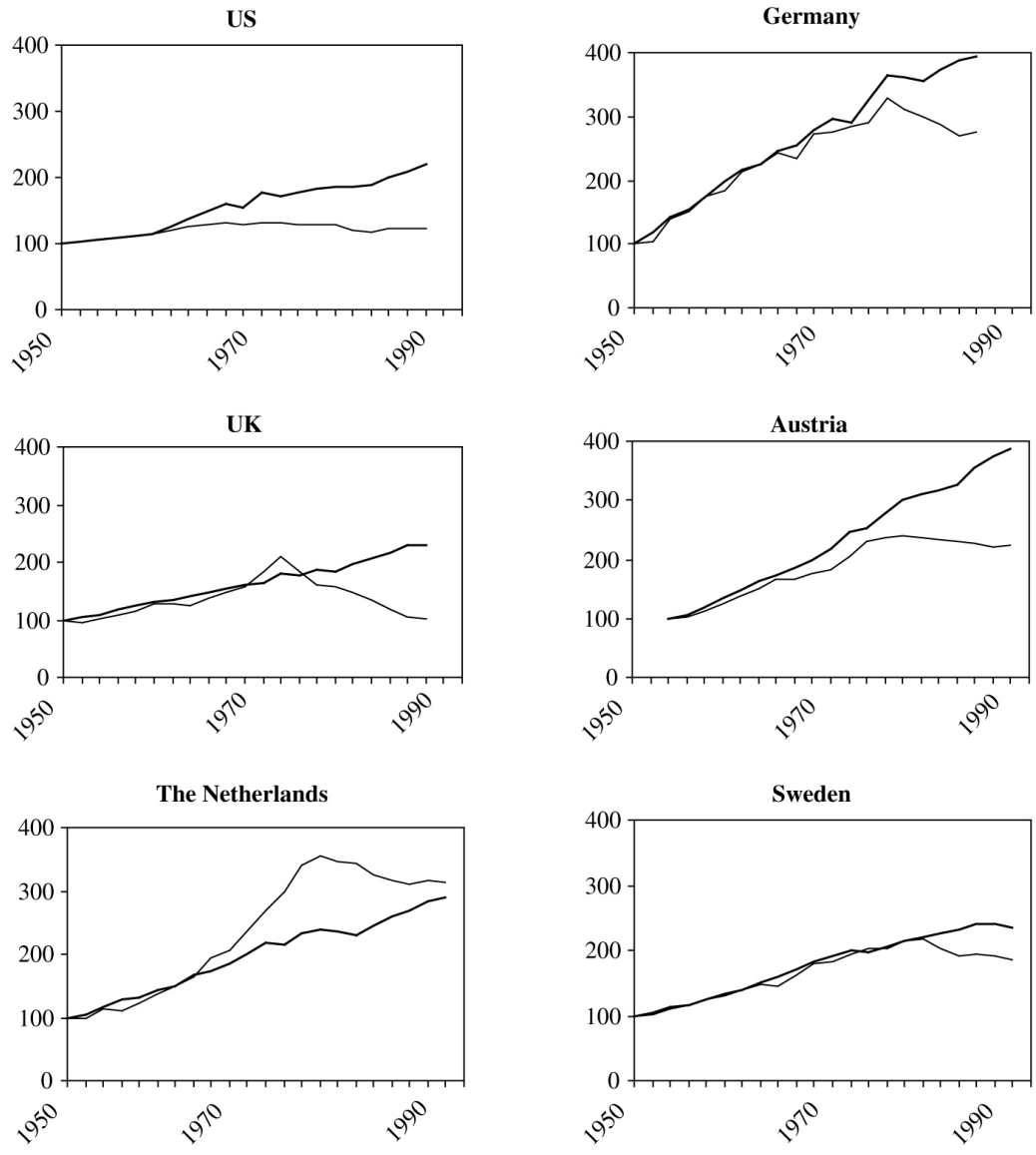
Some Empirical Evidence: GDP, ISEW, GPI

We have seen just how plausible the DMR process is both in general and for some important sectors/organisations. We shall now try to see it at a National level. This attempt comes up against the fact that we do not have an aggregate index widespread enough to evaluate the evolution of social well-being in the course of time. The index which is normally used for this, the Gross Domestic Product (GDP), is in actual fact an extremely poor indicator of well-being because it measures, as we know, the value of all the (finished) goods and services produced within a country's borders in a specific time period. These values thus reflect every type of transaction that takes place on the market, independently of the fact whether it is a matter of benefits or costs. As we know, if environmental disasters, wars or cases of cancer increase, so does GDP.

However, from the end of the '80s a whole series of alternative indicators, such as the Index of Sustainable Economic Welfare (ISEW), the Genuine Progress Indicator (GPI) and the Index of Sustainable Net Benefits, have been developed; they aim to overcome the limitations of GDP and obtain a measurement of the evolution of well-being in time subtracting the various types of (environmental and social) costs (Lawn 2005). As Herman Daly and other ecological economists soon clearly saw, if with the growth in the scale of an economy beyond a certain threshold the various "costs" become greater than the benefits, what is obtained is a sort of paradox, a form of "uneconomic growth" (Daly and Cobb 1989; Daly 1996). Taking these considerations as a starting point, Daly proposed the Index of Sustainable Economic Welfare (ISEW), on the basis of which the other two indices then developed.[6]

The graph in figure 3.12 shows the ISEW and GDP trends in six countries from 1950 to 2000.

[6] The differences between ISEW and the other two indicators are quite insignificant and mainly concern terminology. For a discussion pertaining to the items that make up the various indices, see Lawn 2005.

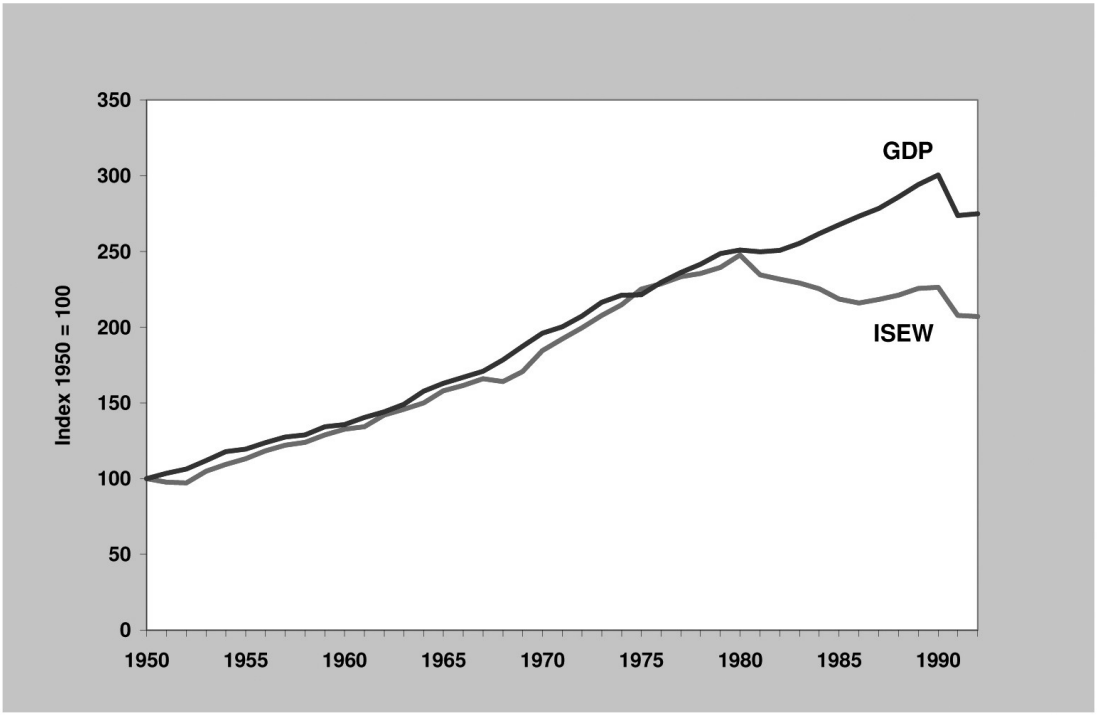


As we can see, all the trends confirm the *threshold hypothesis* (Max-Neef 1995) beyond which the expansion of macroeconomic systems involves costs, associated with their growth, that surpass any additional benefits.

If we consider the average ISEW trend calculated for six European economies, as

shown in Figure 13, we see that on a whole it consistently supports the existence of DMR: the graph shows an ISEW growth for the period 1950-'70 that is essentially similar to that of the GDP, yet from about the early '70s the two indices clearly become quite different. While the GDP continues its basically uniform growth, the ISEW reveals declining increments and then even decreases in absolute terms. Despite some differences, the data pertaining to Germany, Austria, the UK and the USA confirm this tendency.[7]

Illustrative Average ISEW and GDP/cap for EU 6 1950-1992



In short, although at present we cannot draw any definitive conclusions, the data we do have permit us to state that the hypothesis that advanced economies set out on a course of DMR roughly from the mid 1970s, is not only plausible but seems to be confirmed by the first empirical evidence, which obviously requires further research in order to support it. We do not have, for example, any aggregate estimations of ISEW or GPI on a worldwide level, estimations that would permit us to evaluate whether a drop in benefits

[7] Compared to the DMR hypothesis represented in Figure 3.4, one may object that ISEW does not directly measure the "net benefits of complexity". However it represents a fair approximation since, as we have said, the benefits are finally measured after deducting costs, and furthermore we are justified in believing that GDP growth is a good proxy of the complexity of social organisation.

similar to that seen in European and North American economies can also be found on this scale, in accordance with our hypothesis. Clearly, the entry into the global economy of new, particularly Asian, countries, such as India and China, which are presumably still in a phase of increasing returns, may lead global trends to compensate consistently for the decline seen in the USA and, even more markedly, in Europe and Japan.

However, the fact that the mutation threshold may differ from one country to the next, and that some countries are still going through a phase of increasing returns, does not invalidate our hypothesis. One can reasonably maintain that "advanced capitalist economies" (Europe, Japan, and USA) are also those that are the first to enter a phase of DMR. Furthermore, as far as Asian economies are concerned, we shall have to evaluate whether the external limitations imposed by the exhaustion of fossil fuels will permit them to deploy fully their potentialities for growth or whether, as is likely, these limitations will not rather force them to enter a phase of DMR earlier than expected. Needless to say, different time-spans and evolutionary courses remain open to debate.

Globalization and New economy in the age of declining returns

The world crisis of 1968-73 marks the passage from one model of capitalist accumulation to another. The former, which had already gradually developed from the beginning of the century with the large oligopolistic enterprise and was consolidated in the post-war period of consumerism, is what we might call the Keynesian-Fordist model. It is a model characterised by the presence of large, vertically integrated enterprises that, as we have seen, guaranteed throughout the golden age significant increases in productivity and, consequently, remarkably stable labour and accumulation conditions. The period after the 1968-73 crisis, in particular from the '80s, marks the transition to a different model which, with Harvey (1990), we can define as "flexible accumulation". The differences between these two models are so profound that they have been underlined by everyone observing them, albeit in different words. In our opinion, this did not happen merely by chance: those are the years when advanced economies entered a phase of declining returns. The transformation occurred thanks to causes that were both internal and external to the dynamics of capitalist accumulation.

Two important events mark the outset of this new phase: the dollar ceased to be convertible into gold (1971), which started the subsequent process of globalization of the economy, and the oil crisis of 1973, with the consequent increase in the price of energy. One must not forget, moreover, that the 1970s saw an increase in the bargaining power of trade unions and political organisations of the working class. The higher wages, and in general the improved conditions of social security guaranteed by the Keynesian model, unlike those of the '30s, led to an increase in direct and indirect labour costs. The crisis of 68-73, and more generally the crisis of the Keynesian model, unlike that of the '30s, was characterised, therefore, by the tendency of profit rates to

decrease.[8] This announced the entry into the new age of declining returns.

It did not take long for capital to respond. The neoliberalist politics in the early ’80s in Britain and the USA must be considered in this perspective. They represent the reaction of capital to a decade when marginal returns, and more generally the freedom of movement for capital, had been reduced, both because of the increase in the costs of resources and, above all, due to the increased power of the trade unions and the working class.

It is not merely by chance that from the 1980s the key words used by the world of enterprise have been flexibility and outsourcing. They both aim to contain costs, the former by creating new forms of flexible, precarious labour, the latter by externalising significant parts of the productive process, frequently transferring production to countries, such as free-trade areas in Asia, characterised by low labour costs. It is a process that involved first, and to increasing degrees, the great transnational enterprises, capable of outsourcing more easily, but which gradually spread until it involved the whole of the productive tissue in the Western world, including medium and small enterprises. However, it is obvious that if the hypothesis of the maximisation of profits describes sufficiently well the behaviour of the large, multinational corporation that decides to place its resources where capital will obtain maximum returns, this is not enough to explain the outsourcing of small firms, which have always had their roots in the local territory. What drives a small manufacturing entrepreneur, for example, to move his plant abroad if not the need to do so in order to avoid the risk of closing down?

This helps us to understand how the pervasive process of *globalization* that the economy has undergone since the ’80s cannot be explained, we believe, by simply attributing it to the greed of capital, but rather by the far more pervasive entry of advanced economies into a phase of declining returns. In this framework, even the processes of outsourcing can be better explained as the adaptive response of enterprises to the new situation. The data for profits in the following thirty years reveal how highly successful, from the point of view of capital, the operation has been.

The “internal” effects in advanced capitalist societies, however, have not been so good. The massive transfers of production of the Fordist type towards countries with low labour costs posed advanced countries the dilemma of which new organization they had to establish for their economic system. The answer was found in the complexity of the transformational processes known as *tertiarization* of the economy. Once production had been transferred, capital concentrated on the financial control of property, brands and distribution. For enterprises this meant a new pivotal role for financial, marketing

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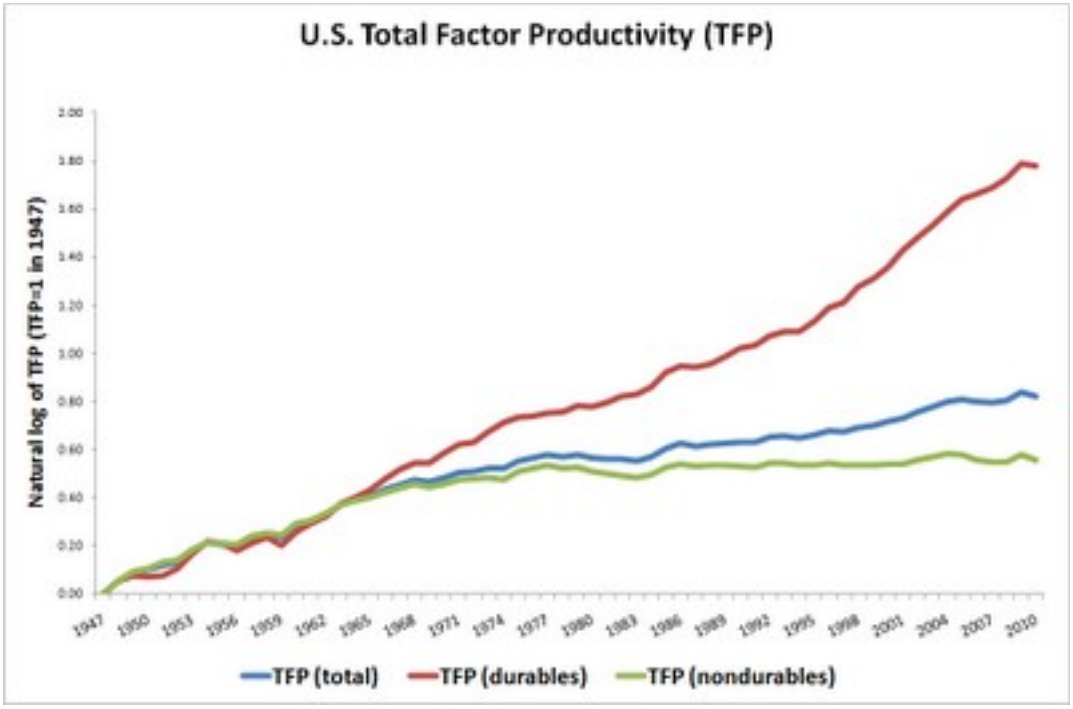
[8] From this perspective, see also Arrighi 1999.

and commercial functions together with the development of a whole network of information, insurance, legal and communication *services*. For its part, the public sector was called upon to offer a multifarious group of services, from education to training, and from transport to communications, which somehow permitted capital to carry out its own function of accumulation competitively.

However, this metamorphosis in organisation has had diverse consequences: an essential characteristic of this new tertiary economy is that it centres around a set of qualitative services that *cannot be standardised* and are often carried out on the basis of *one-to-one* relationships, thus being unable to generate the economies of scale typical of the Fordist standardised production, which had characterised the golden age.

Figure 3.14 presents the trend of productivity of durable and non durable goods from 1947 to 2010. From this trends it definitely looks as if something important did happen to technological progress at about the end of the Sixties[9]. As we can see, the Great Stagnation in TFP we have already observed for the American economy as a whole, is mainly due to stagnation in the sector of "non-durables" (services, etc.), which from that period became the most significant.



[9] For an interesting debate on this point see http://noahpinionblog.blogspot.it/2011/04/tfp-and-great-stagnation.html

Fig. 14 U.S Total Factor Productivity (Durables and Nondurables)

Naturally, this “new economy” has been presented with all the rhetorical emphasis becoming every new recipe, which, even if it is not good, at least has to appear so. At first, the transition from the smoky old factories to the new information economy undoubtedly had some advantages, at least in terms of the quality of urban life, but in the long term the impossibility of transferring to the services sector increases in productivity generated by the Promethean Revolution first, and then by long wave of Fordism, led to the emergence of declining returns.

In this framework, the transformations undergone in the world of work can also be explained more convincingly. First of all, from 1970 we have witnessed a reduction in wages in the western world that continues until today.

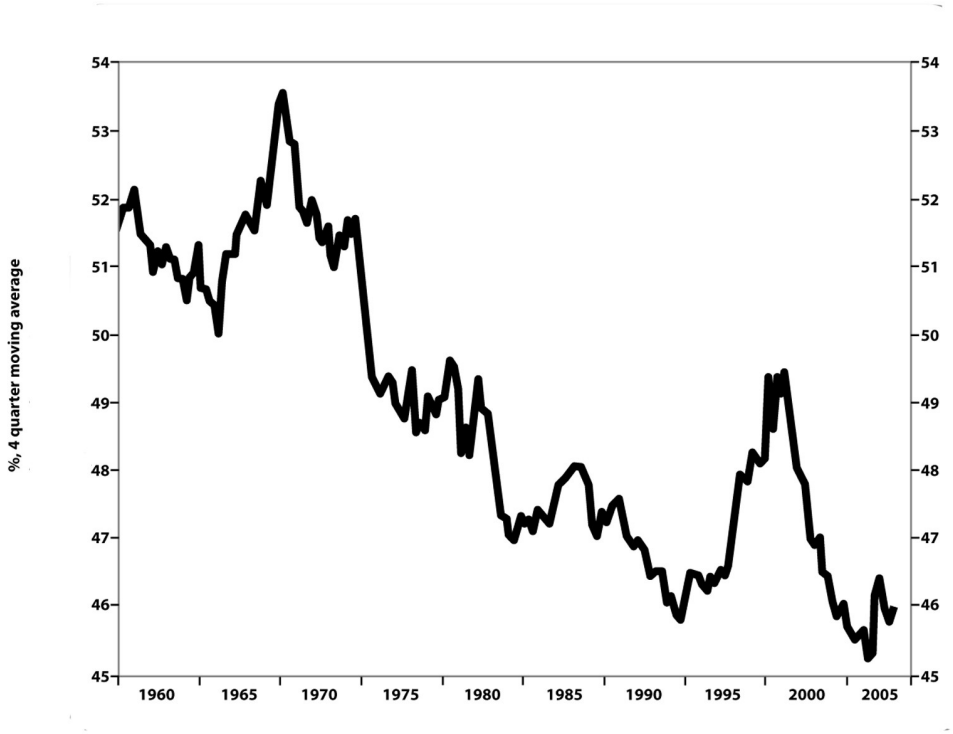


Figure 15. Wages in the USA (1950- 1995)

How can this tendency be explained? It is usually recalled that, on the one hand,

the use of high-intensity capital technologies, in increasing unemployment, reduces workers' bargaining power, and, on the other hand, that the possibility for global capital to be transferred to areas where there is a more abundant workforce permits it to drastically reduce labour costs in the West[10]. Most of the reduction in wages in the period analysed can hence be explained by the greater bargaining power of capital, which takes permanent advantage of the destruction of the system of industrial relationships typical of the Fordist model.

However, in the last thirty years the labour force has suffered not only a quantitative loss of wages but also a qualitative transformation that has changed the way of working. The transformations connected to so-called *cognitive capitalism* (Gorz, 2010, Moulier-Boutang, 2012) has ended up by setting increasingly greater life space and personal abilities "to work". Increases in hours of work and times connected to mobility and precarious forms of contracts for projects, or even piece-work, are just some of the expressions that remind us how much the "pressure on work" has increased in the age of declining returns. What we have said thus far should be sufficient to explain that it could not have been otherwise within such a framework.

In conclusion, what we are now witnessing is not so much (or only) a resurgence of the greed of capital, or a simple shift in the distribution of power from labour to capital, as the metamorphosis of capitalism in times of flexible accumulation has often been interpreted, but rather the consequence of an old conflict in a new framework, that of DMR. Once the years of increasing returns, when increasing productivity afforded advantages to both sides, were over, the conflict over distribution could not but become fiercer, crushing the weakest link in the chain.

The Fragmentation of Nation-States and the Collapse of the Soviet Empire

In our analysis of the evolution of advanced capitalist societies we have not yet considered the role of the State. According to Hobsbawm, from the eighteenth century to roughly the 1970s, Nation-States continually extended their influence and functions. Independently of economic or political circumstances, this reinforcement was such that at the end of the process many of the fundamental parameters that regulated the lives of modern citizens depended, in one way or another, on the activities of the State (Hobsbawm, 1994). The age of growth, therefore, is accompanied by an increase in the complexity of state apparatuses. This fundamental process, which by then had lasted some centuries, also seems to have been interrupted in the '70s. From that time a true and proper process of fragmentation of Nation-States into smaller entities can be observed. It suffices to say that the United Nations, that originally comprised 51 States, now boast 192 members. (Harvey, 2010, p. 208)

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[10] Cf. Harvey, The Enigma of Capital, 2011

These signs of a crisis, and a general trend towards the decomplexification of state apparatuses, can be evinced in a whole series of phenomena. First of all, the crisis of Soviet communism extended the movement towards disgregation of the countries in the former Soviet block, where from 1991, more Nation-States were formed than at any other time in the twentieth century (Hobsbawm, 1994, p. 425).

In other countries, for example in Afghanistan or in parts of Africa, the process of decomposition that began in the ’80s and ’90s has not led to the formation of new, smaller States but basically to a situation of anarchy. The recent rise in separatist and autonomist movements can be seen in the same perspective. This has mainly been a European phenomenon, found in Great Britain, Spain, Italy, Belgium, even in Switzerland and Denmark, but it can also be observed in Canada and, obviously, in Yugoslavia. Even taking into consideration the noticeable historical and cultural differences among these cases, the drives towards separatism frequently have their origin in subsystems, which, as is the case of the Northern League in Italy, believe they may gain some advantages from obtaining a greater degree of autonomy from the system as a whole.

Thus the entry from the mid ‘70s of advanced economies into a phase of declining returns is accompanied by a true and proper fragmentation of the old Nation-States and, in 1989-91, by the collapse of the Soviet empire. While it is probably too early to draw any definitive conclusions in this regard, this correlation cannot, however, go unnoticed: as we shall see better in the next chapter, the break-up of complex systems and their re-formation in simpler units is the first sign of the collapse subsequent to a DMR phase.

Although the collapse of the USSR is a process that still partly needs to be explained, there can be no doubt that it has its roots in the Russian economic decline, burdened as it was in the 1980s by the consequences of military competition with the USA and bled dry by the war in Afghanistan. Michail Gorbachev’s *glasnost* and *perestrojka* thus led to the emergence of the rigidity and structural weaknesses of an economic system that before the reforms not only could not count on either a first or a third sector but which even in the second, that of state enterprises, presented passivity and a great lack of flexibility. In these conditions, one can see how continually altering external pressures, to which the USSR had opened the doors from the ‘70s, produced a change that was so rapid that it resembled a true and proper collapse. On the other hand, one should not be surprised that, within a framework of declining returns, it was the most extensive, economically weakest and most rigidly structured entities that would be the first to collapse.

The Decline of the Welfare State and the Crisis of Public Debt

The collapse of the Soviet Union and the fragmentation of the weakest Nation-

States clearly represent, for those who know how to interpret them, blatant signs of the process we are analysing. Although DMR have not yet produced similar consequences in the organisation of the State in the strongest countries, there is no lack of signs of the crisis. One way in which the process described is generally manifested in the "structure" of the wealthiest nations is in what we might define as the crisis in the welfare state and the increasing indebtedness of the public sphere.

It is interesting to note that the "public sector" is a more sensitive indicator of the outset of DMR dynamics than the private one. While the world of enterprise, at least in capitalist countries, is called upon to respect a healthy balance between costs and benefits and, when conditions become critical, can always seek to externalise a whole series of costs (which, as we have seen, has widely been the case), the public sector, which is not called upon to respect so rigorously budget constraints, and which mainly has to bear the burden of the costs externalised by the private sector, is more exposed to approaching DMR conditions.

Not merely by chance do we witness, once again from the 1970s, a well-documented crisis in the welfare state. From that time on, States have found themselves doubly burdened: on the one hand, by reduced tax revenues connected to slower rates of growth and, on the other, by a greater demand for public intervention linked to the increase in economic, social and environmental malaise.

The table below shows the increases in Public Debt in percentage of GDP from 1980 to 2003 for some important economies:

	1980	1990	2000	2010
Austria	24,8	46,0	61,2	65,8
Belgium	53,5	106,7	99,5	96,8
Germany	13,0	19,7	38,4	44,4
Iceland	22,9	32,0	33,8	81,3
Italy	52,7	92,8	103,6	109,0
Portugal	29,2	51,7	52,1	88,0
Spain	14,3	36,5	49,9	51,7
United States	25,7	41,5	33,9	61,3

Source: OECD StatExtracts http://stats.oecd.org/index.aspx?queryid=8089#

Figure 17 Total Public Debt in % of GDP 1980-2003

As we have been able to observe for the last three decades, in all the principle world economies the increase in public debt is greater than that of GDP. It is, therefore, a structural transformation, not a short term tendency.

It is furthermore interesting to note that these increases have occurred no matter which political stance the ruling class assumes in fiscal policy. When, in the 1980s, the theories of "the minimum state", which were also supported by international institutions (IMF, World Bank), became established, following the neoliberalist reforms of Thatcher's and Reagan's governments, public debt almost doubled on a worldwide level.

Needless to say, there had been situations of a structural increase in public debt in the past but only in the case of war. Now, on the contrary, we find systematic increases in the Debt to GDP ratio not only in peacetime but even when the political leaning of governments is against public debt. This is the first time in the history of capitalism that this has happened.

In the '80s the most significant contribution to the increase in public debt came from the very United States themselves, where the reduction in taxes was not compensated by corresponding cuts in expenses. During the twelve years of Republican

administration, due above all to increases in military expenditure, public debt increased sixfold.

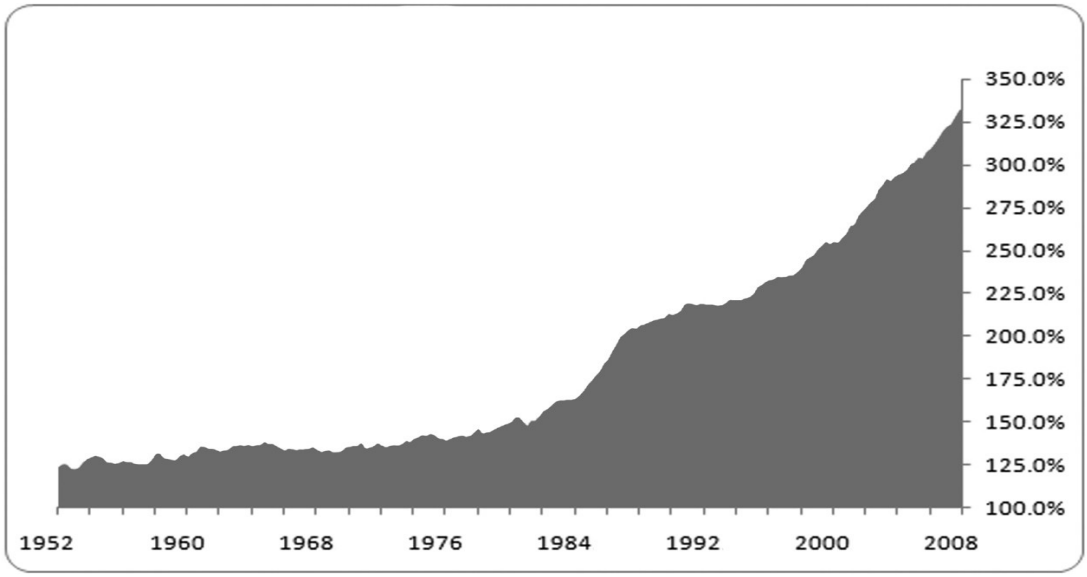

Figure 18 Trend of Total USA Debt as % of GDP

If in the ’90s the pace of the increase in the debt of the major economies temporarily slowed down (thanks also to the stabilising policies foreseen by the Maastricht treaty), in the early years of the twenty-first century it picked up again, due both to the attempts to revitalise the economy after the 2001-2002 crisis and to the further cuts made to incomes by the Bush administration; today it reveals predominantly structural nature, about 80% of GDP for the EU and 90% for the USA (Indiviglio, 2011); however, more recent data show the US debt to be on the increase, and the figure indicated does not even take into consideration the debt of local administrations.

Among advanced countries, the case of Japan is also particularly significant. In the 1990s the country already had a severe public debt that was on the increase (over 130% of GDP) and, despite considerable injections of public money, for a long time the Japanese economy has no longer been able to grow, not only in terms of well-being but also in GDP.

In this situation of high global debts, which was already alarming for some countries, the 2007-2009 crisis set in. The pressing need to save the financial system from collapsing, according to cautious estimations, cost western governments about 14-15 trillion dollars, an amount we can consider equivalent to the US GDP in 2010. This could only aggravate global debt, so much so that, for some weaker countries (PIIGS), five years after the crisis, the possibility of a default of the State has become a topic of everyday debate.

One cannot fail to see in all these processes a sign of the “decline” of the present

socio-economic system; this obviously poses great questions as to its sustainability in the long term. Since benefits decline in the long run, the question must obviously be raised about how capitalist economy may continue to prosper and still be legitimated by citizens. Continuing along this course will evidently drive the system into an area of instability, economic crisis and finally discontinuity, from which different scenarios may result (Bonaiuti, 2014).

Some transition dilemmas

All this considered you may wonder what my suggestions are for intervention. I am not going to give you here another list of proposals. Also I have to admit that my proposals - which you can find in the last chapter of my book – are in line with those of Serge Latouche in his well-known programme of the 8 R's. Moreover - in complexity perspective that I have – we should be aware that any proposal that does not take into account the specific context and the agents who inhabit it - is destined to be mere "wishful thinking".

So I will conclude highlighting some dilemmas that any attempt to implement transition policies is likely to encounter.

1. The dilemma of finance. This concerns the global level. The first action to be taken in a context of DMR would probably be "deglobalizing" the world economy. This would first mean downsizing the financial system and bringing it under strict control. Of course this would require "global awareness" that we have entered a path of diminishing returns, and that there are risks connected to it. But, since the financial systems are based on future expectations, no one can talk about decline or even mention DMR, because this may cause a financial collapse. As you can see we are trapped in a vicious circle.
2. Industrial Self-sufficiency. Many authors suggest - not only from a degrowth perspective - that each country should regain its self-sufficiency, at least in key sectors such as food, energy and some industrial sectors. This would mean developing an industrial policy - primarily at the national level - to counteract delocalization and give new impetus to employment. (Among other things, this is a point on which degrowth supporters could build new alliance with the supporters of the old Fordist-Keynesian model*)*. But the development of domestic industry means reducing imports. And you cannot imagine doing this in a globalized economy without expecting other countries to do the same. This could cause tensions among national states and risk feeding nationalism. Of course you could develop policies between European countries in order to compensate for these tendencies, but that would mean pretty much rewriting the fundamental rules that are the basis of the European institutions from at least the Treaty of M, and this would not be easy.

3. The Paradox of the solidarity economy. All degrowth thinkers believe that we should re-embed economy back to a local and social dimension. And I agree. The main problem with solidarity economy organizations is that they move at a scale too small to be able to offer effective responses to the general public. But the change of scale would necessarily require the support of other agents (such as local authorities) and the redefinition of rules determined at levels (regional, national) where such organizations have no access.

These are some of the dilemmas that the "great transition" has to face, but we should not be disconcerted by them. As Cornelius Castoriadis would say, these are typical problems that that the instituting society encounters when it meets the rigidity of the already "instituted" rules.

There is, however, after all these rather discouraging considerations, a piece of good news: if the DMR hypothesis is correct, we will be hearing about Degrowth for a long time.

This is basically due - as we have seen - to the permanence of some “processes" (both material and social) that -if I am right- will recur relentlessly; forcing people and policy makers to take into consideration something they would gladly do without.

So long live degrowth!

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