Scientific Evidence of Why Complementary Currencies are Necessary to Financial Stability

By Bernard Lietaer[1]

Abstract
A recent theoretical breakthrough makes it possible to measure quantitatively the sustainability of any complex flow network. This framework has been empirically confirmed by 25 years of data about natural ecosystems, all examples of large scale sustainable systems. This approach proves that a minimum of diversity is necessary for stability: a monoculture is never sustainable. An economy is also a complex flow network through which money flows. However, orthodox economic thinking imposes precisely such a monoculture in the monetary domain through a single national currency. This explains the systemic financial and monetary instabilities that have plagued economies around the world. Contrary to orthodox thinking, complementary currencies turn out to be a necessary tool to attain stability. Whenever a banking or monetary meltdown takes place, authorities invariably return to the "normal" monetary monoculture as soon as possible, guaranteeing the return of systemic instabilities in the future.

Background

Conventional economists tend to regard complementary currencies as an anomaly, to be dismissed as an irrelevant or romantic distraction. Regulators tolerate them, as long as they remain marginal. If ever any were to grow to a relevant size, they believe such monetary innovations should be suppressed because of concerns that they might disturb monetary policy or reduce the efficiency of the price formation process (Rösl, 2006)

A recent scientific breakthrough provides the evidence that a systemic cause for the prevailing monetary and financial instability happens to be the monopoly of one single type of currency. In fact, it will be shown that, far from being a disturbance, a variety of monetary media is *necessary* for the economic and financial stability in a society.

Indeed, there exists a structural flaw in our Modern monetary system, a flaw that has been with us for centuries. Actually, it was already "doing its thing" when the Dutch tulip bubble burst in 1637, and it played an unacknowledged role in every crash since that time, including the one we are experiencing now! The proof for this claim comes from fundamental laws that govern all complex flow systems, including natural ecosystems, economic and financial systems. It is based on a recent theoretical breakthrough which makes it possible to measure quantitatively with a single metric the sustainability of any

[1] The author wants to thank particularly Robert Ulanowicz, Sally Goerner and Nadia McLaren for their direct or indirect contributions to parts of this paper. We were all co-authors in an article published under the title "Is our monetary structure a systemic cause for financial instability? Evidence from Nature" in the special issue about the financial crisis of the *Journal of Future Studies* February-March 2010. Parts of this paper are summarized here, with permission from that Journal.

complex flow system as an emergent property of its structural diversity and interconnectivity. Furthermore, it is revealed that whenever diversity in a complex flow network is being sacrificed because of too much emphasis on efficiency, systemic collapses are a totally predictable consequence.

From this perspective, it is obvious that we have been living worldwide with a monoculture of the same type of media of exchange, in the form of a single national currency monopoly in each country, created everywhere through bank-debt. Both the Marxist and the various capitalist schools of economic thought have been blind to this issue: they all impose a monopoly of a single national currency. The main difference in this respect between communism of the Marxist-Leninist variety on the one side, and capitalism on the other, was that in the former governments were the owners of the banks, while in the latter private investors are normally supposed to be in control. But the money system itself is in fact the same: a single national currency created through bank-debt…The structural solution to economic and financial sustainability becomes also clear: we need to diversify the types of currencies available in a society and the types of agents that are creating them, specifically through complementary currencies.

Sustainability of Complex Flow Systems

We now can prove that a structural fault is involved in generating financial crashes. Understanding and empirical substantiation of this mechanism has arisen from quantitative ecological research. For those desiring a fully documented step by step mathmatical proof of what will be claimed here, please refer to the seminal paper (Ulanowicz, Goerner, Lietaer and Gomez, 2009). The most relevant points are summarized next.

Information is any "difference that makes the difference" (Gregory Bateson) and, as the binary logic of the digital age has popularized, such difference almost always involves the absence of something. In coming to terms with the working of whole systems, information theory (IT) is a means for apprehending and quantifying what is missing. The key point is that if one is to address the issue of sustainability, then the inchoate, undetermined "potentiality" of a system also becomes an indispensable focus of inquiry, because it is the source of the resilience that allows the system to persist (Conrad, 1983).

What IT tells us is that a system's capacity to undergo change has two components: order and the absence of order. The first component, called "mutual constraint", quantifies all that is regular, orderly, coherent and efficient. It encompasses basically all the concerns of conventional science. This first component, is an analogue of Newton's Third Law of motion, or of the Chinese *Yang* construct. By contrast, the second component represents the lack of those same attributes, or the irregular, disorderly, incoherent and inefficient potential behaviours that have escaped the scrutiny of science mainly because they cannot easily be described, and even less readily repeated or measured, or all of the above. It corresponds to the Chinese *Yin.*

In the jargon of IT, this second, usually overlooked component of system change is called ''conditional entropy"; it can also be thought of as uncommitted potential. Critically what this says is that the very absence of order (even if its potential is never

activated, and therefore unnoticed and unmeasured) plays the key role for a system to persist over the long run, to adapt to changing environment, or survive unexpected challenges. It will be shown next why this absence of order happens to be even more significant than the first variable, order, if we are to understand sustainability.

A living system adapts in homeostatic fashion to buffer performance by expending what Odum called "reserves" (Odum, 1953). The reserve in this case is not some palpable storage, like a cache of some material resource. Rather, it is a characteristic of the system structure that reflects its flexibility both to survive change and to adapt to new circumstances – and it usually requires some loss of efficient performance (Ulanowicz, 2009, 2010). Systems that endure – that is, are sustainable – lie in dynamic balance somewhere between these two poles of order and disorder, efficient performance and adaptive resilience.

Let us now define more precisely our terminology:

- *Efficiency* is defined as the capacity of a complex flow system to process volume of whatever flows through it, per unit of time (e.g. grams of biomass per square meter per year for a natural ecosystem; GNP/per capita in an economy; or billions of dollars per day in an electronic payment system).
- *Resilience* is the capacity of a complex flow network to survive an attack, a disease, or adapt to a change in the environment.

So crucially, as we have seen, efficiency is definitely not a sufficient metric for sustainability. This confirms the often repeated point that GNP/capital is not sufficient to assess economic sustainability. Indeed, this metric cannot distinguish between a healthy sustainable growth and a short-term bubble doomed to collapse. For a complex flow system to be sustainable, it is also necessary that it possesses enough resilience, an undefined and contingent responsiveness to the unpredictable challenges thrown up by its own workings and its environment. It is thanks to this feature that a resilient flow network of any kind can withstand shocks and adapt itself when necessary.

A Chinese Insight

"When Yang and Yin combine appropriately,
all things achieve harmony."
Lao Tse *Tao Te King* #42.

This dialectic between efficiency and resilience is the "go and get" and the "let go and give" of life. In the Chinese philosophical tradition, respectively *yang* and *yin*, characteristics were assigned to all natural systems.

In short, to our knowledge, for the first time Western science is able to prove in a quantitative way the validity and depth of this Taoist discovery. So let us give credit to this ancient Eastern insight which has been so widely ignored in the West, to the point we don't even have words to capture their meaning.

These concepts, always combined in Asia as *Yin-Yang,* are seen as *necessary complements* to each other. They have a history of several thousands years, with its written origins traced back to the *Yi Jing* (the *Book of Changes)*, attributed to King Wen of Zhou (1099-1050 BC). The explicit *Weltanschauung* in Chinese philosophy is precisely the necessity of an appropriate balance between *Yang* and *Yin* energies, in all aspects of nature and life.

C.G. Jung was one of the first to express regret that our Western culture is not more familiar with this concept: "Unfortunately, our Western mind, lacking all culture in this respect, has never yet devised a concept, nor even a name, for the 'union of opposites through the middle path', that most fundamental item of inward experience, which could respectably be set against the Chinese concept of Tao."[2]
If we are using this Yin-Yang vocabulary, at the risk of appearing exotic, it is simply because we don't have any equivalent words in any of our Western languages.

Oriental philosophers have developed an infinite number of ways to describe the Yin-Yang relationship and polarity. The following figure offers those selected as most relevant for our purpose.

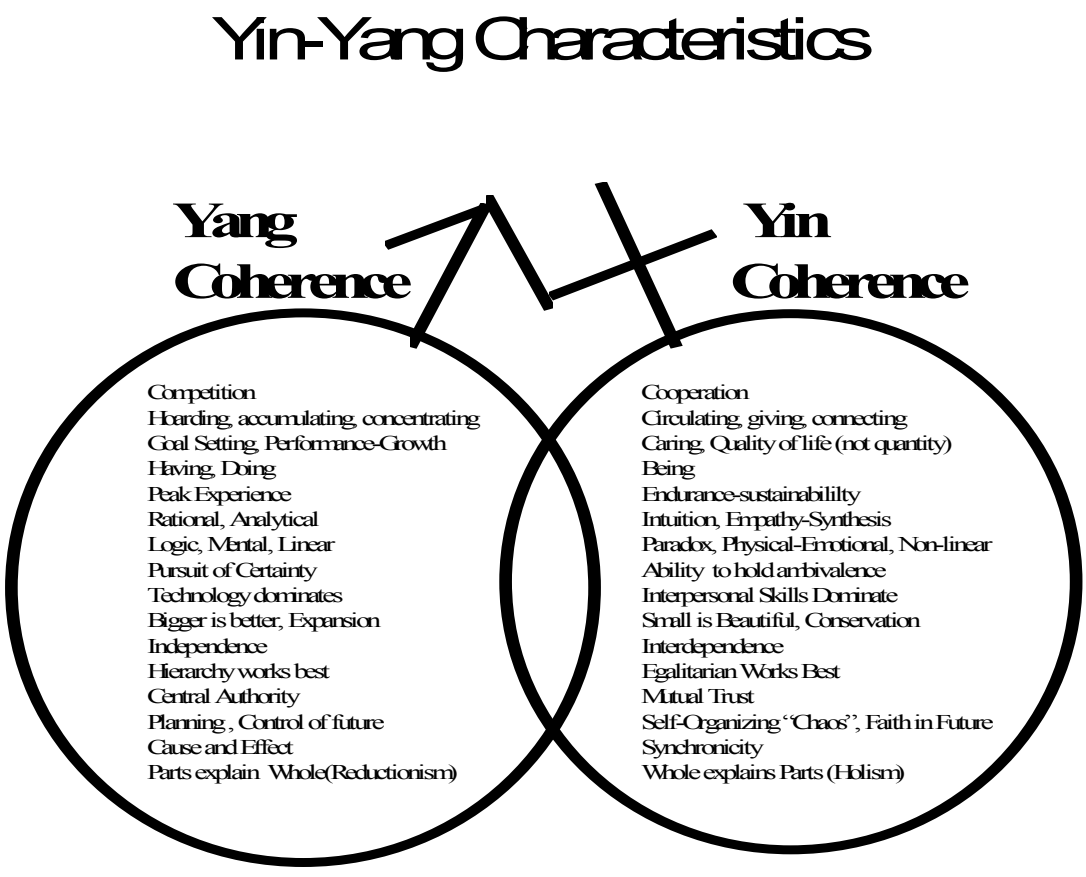

Figure 1: Some Yin-Yang Coherences and Polarities

[2] Jung, C.G. Collected Works (translated by R.F.C. Hull) Vol III, pg 203

This figure can be read vertically, emphasizing the internal coherences. Or it can be read horizontally, emphasizing the polarity between them. One advantage in using the Yin-Yang vocabulary is that Taoists never separate such polarities. They emphasize the connection between them - their *complementarity.* In clear: both are indispensable!

The Yin-Yang way of looking at reality are not competing ways to relate and interpret reality, not more than your right eye competes with the left one. Instead, because of their differences, together they provide you with range and depth of vision, something which neither one can do by itself.

For the past millennia, all patriarchal societies have tended to impart legitimacy to the vision contributed by only the male half of its "eyes". We have thereby projected a hierarchical duality on concepts such as activity/passivity, creative/receptive, culture/nature, mind/senses, spirit/matter; invariably claiming the former to be somehow "better" than the latter. What matters here is not to deny the qualities inherent in the masculine viewpoint, but to empower the feminine to an equal level. A shift in consciousness towards giving equal emphasis on both views is about more than fairness; it may be the key to provide a synergistic impulse towards the sustainability of our species.

"The feminine and the masculine are not objects, not things, not simply biological bodies we are attempting to unite, but rather complex, archetypal organizations of consciousness…What is needed is a recognition of the synergy between these polar opposites. Synergy is evident everywhere in nature, and is an important source of causation in the ongoing evolutionary process. Since the relationship between male and female is fundamentally synergistic, it is essential that we rethink and recreate our cultural and symbolic understanding of the feminine and its relationship to the masculine to increase the possibility that the human species will co-create an evolutionary change that is advantageous to the entire biosphere. If we do not, we are in danger of bringing about our own extinction…"[3]

Not surprisingly, in all patriarchal societies a Yang bias is accepted as "normal`". In contrast, the poet John Keats coined the term "negative capability" for the often overlooked *yin* trait of human personality and experience: the capacity to hold uncertainty without angst – the capacity to live with the unknown as an ally rather than something to be eliminated. It is more like a connection to an undifferentiated ground that resists form, which continually invokes questions and reflection and is potentially multi-dimensional, a space of "both-and" and *neti-neti*, the Hindu concept literally meaning "neither this, nor that".

In summary, natural ecosystems exist because they have *both* sufficient self-directed identity *and* flexibility to change. The polarities necessitate each other in an appropriate balance in harmonious complementarity. Over time, nature must have solved many of the

[3] Dwyer, Molly "Complexity and the Emergent Feminine: A Cosmological Inquiry into the Role of the Feminine in the Evolution of the Universe" (Winning Paper of the 1999 Vickers Award International Society for the Systems Sciences, Asimolar, CA)

structural problems in ecosystems. Otherwise, these ecosystems simply wouldn't exist today. They are our best living examples of large scale and long-term sustainability in action.

Empirical Ecological Evidence

The key conclusion is that nature does not select for maximum efficiency, but for a balance between the two opposing poles of efficiency and resilience. Because both are indispensable for long-term sustainability and health, the healthiest flow systems are those that are closest to an optimal balance between these two opposing pulls. Conversely, an excess of either attribute leads to systemic instability. Too much efficiency (excess Yang) leads to brittleness and too much resilience (excess Yin) leads to stagnation: the former is caused by too little diversity and connectivity and the latter by too much diversity and connectivity.

Sustainability of a complex flow system can therefore be defined as the optimal balance between efficiency and resilience of its network. With these distinctions we were now able to define and precisely quantify a complex system's sustainability in a single metric. However, the object of our interest involves in reality four dimensions, and is therefore hard to visualize mentally or graphically. What we can show here in Figure 2 is a simplified graph that provides a two-dimensional illustration that is at least conceptually valid.

Observe that there is an asymmetry: in natural ecosystems optimality requires more resilience than efficiency! (The optimal point lies closer to resilience than efficiency on the horizontal axis).

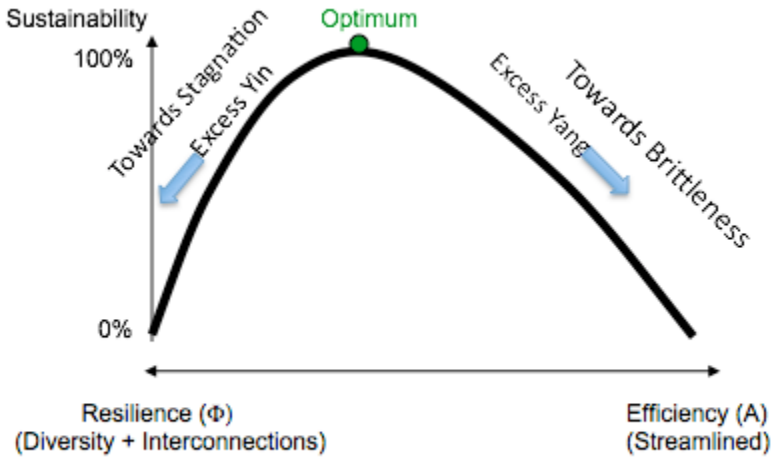

Figure 2: Simplified sustainability curve mapped between the two polarities of efficiency and resilience. Nature selects not for a maximum of efficiency, but for an optimal balance between these two requirements. This fundamental insight is at

the core of theTaoist worldview: Chinese philosophy described this as the optimal balance between Yin-Yang, with excess Yin and excess Yang forms of unbalance.

Moving beyond information theory, ecologists have measured the transfer of biomass and energy ("trophic exchanges") within ecosystems. They have also found ways to derive values for an ecosystem's throughput efficiency and resilience by estimating network size and network connectedness in terms of two structural variables: diversity and interconnectivity. It turns out that there is a specific zone of optimal robustness, into which all observed natural ecosystems fall. This zone has been named the "window of viability" (in ecological literature the "window of vitality").
(See Figure 3).

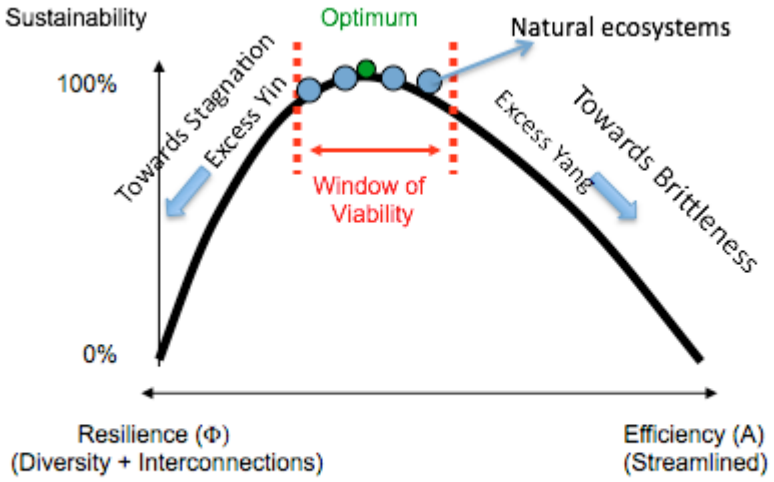

Figure 3: The "Window of Viability" in which all sustainable natural ecosystems operate. Complex natural ecosystems invariably operate within a specific range on each side of the Optimum point.

Application to Other Complex Flow Systems

The question will undoubtedly be raised whether what we learn from ecosystems still makes sense when applied to other complex flow systems, such as economic or financial systems.

It is critical to understand that the findings described in natural ecosystems arise from the very *structure of a complex flow system*, and therefore that they remain valid for any complex flow network with a similar structure, regardless of what is being processed in the system. It can be biomass in an ecosystem, information in a biological system, electrons in an electrical power network, or money in an economic system. This is precisely one of the strong points of using a web-like network approach instead of machine-like metaphor.

The fields of engineering, business and economics have all been focusing almost exclusively on efficiency, and therefore constitute a wide-open field to explore the validity of the proposed metrics to improve sustainability. For example, electrical power grids have been systematically optimized for decades towards ever greater technical and economic efficiency. It has come as a surprise to many engineers that, as they have approached higher efficiencies, suddenly large-scale blackouts have been breaking out with a vengeance "out of nowhere". For instance, a few decades ago several blackouts hit large areas of the United States and Northern Germany. The data should be available to model these systems as flow networks, because that is what they literally are. One could then quantify their efficiency and resilience, and their Window of Viability. The solution on how to rebalance such a system to make it less brittle, and to determine its optimal sustainability, would be an obvious "hard science" test application of the concepts and metrics described here.

The point being made here is truly profound and has wide-reaching implications for all complex systems, natural or human-made. Placing too much emphasis on efficiency tends to automatically maximize flows, size and consolidation at the expense of choice, connectivity and resilience until the entire system becomes unstable and collapses. In contrast, conventional engineering, economics and finance assumes invariably assumes that more efficiency is always better!

Until this finding, total throughput and efficiency have been the only means for us to identify the relative success of a system, whether in nature or in economics. For example, in ecosystems, as in economies, size is generally measured as the total volume of system throughput/activity. Gross Domestic Product (GDP) measures size this way in economies and Total System Throughput (TST) does so in ecosystems. Many economists urge endless growth in size (GDP) because they assume that growth in size is a sufficient measure of health. GDP and TST, however, are both poor measures of sustainable viability because *they ignore network structure*. They cannot, for example, distinguish between a healthily thriving resilient economy; and a bubble that is doomed to burst. Or between healthy "development," as Herman Daly (1997) describes it, or explosive growth in monetary exchanges simply due to runaway speculation.
Now, however, we can distinguish whether a particular increase in throughput and efficiency is a sign of healthy growth or just a relatively short-term bubble that is doomed to collapse.

Application to Financial and Monetary Systems

Applying the above complex flow framework specifically to financial and monetary systems, we can predict that excessive focus on efficiency would tend to create exactly the kind of bubble economy which we have been able to observe repeatedly in every boom and bust cycle in history, including the biggest bust of them all, the one triggered in 2007-8 from which we are still experiencing the fall-out today.

If we view economies as flow systems, this ties directly into money's primary function as medium of exchange. In this view, money is to the real economy like biomass in an ecosystem: it is an essential vehicle for catalyzing processes, allocating resources, and generally allowing the exchange system to work as a synergetic whole. The connection to

structure is immediately apparent. In economies, as in ecosystems and living organisms, the health of the whole depends heavily on the structure by which the catalyzing medium, in this case, money, circulates among businesses and individuals. Money must continue to circulate in sufficiency to all corners of the whole because poor circulation will strangle either the supply side or the demand side of the economy, or both.

Our global monetary system is itself an obvious flow network structure, in which monopolistic national currencies flow within each country (or group of countries in the case of the Euro), and interconnect on a global level. The technical justification for enforcing a monopoly of a single currency within each country is to optimize the efficiency of price formation and exchanges in national markets. Tight regulations are in place in every country to maintain these monopolies. Banking institutional regulations further ensure that banks tend to be carbon copies of each other both in terms of their structure and behaviour. This was demonstrated among the world's bigger banks, most recently and with a vengeance, with the simultaneous crash of 2008.

Furthermore, in a seminal 1953 paper, Milton Friedman proposed that letting markets determine the value of each national currency would further improve the overall efficiency of the global monetary system (Friedman, 1953). This idea was actually implemented by President Nixon in 1971, to avoid a run on the dollar at that time. Since then, an extraordinarily efficient and sophisticated global communications infrastructure has been built to link and trade these national currencies. The trading volume in the foreign exchange markets reached an impressive $4 trillion *per day* in 2010*,* to which another daily $2.1 trillion of currency derivatives should be added (Bank of International Settlements, 2011). Over 95% of that trading volume is speculative, and less than 5% is in fact used for actual international trade of goods and services.

Speculation can play a positive role in any market: theory and practice show that it can improve market efficiency by increasing liquidity and depth[4] in the market. But current speculative levels are clearly out of balance. Although over half a century old, John Maynard Keynes' opinion has never been as appropriate as it is today. "Speculators may do no harm as bubbles on a steady stream of enterprise. But the position is serious when enterprise becomes the bubble on a whirlpool of speculation. When the capital development of a country becomes a by-product of the activities of a casino, the job is likely to be ill-done." (Keynes, 1936)

Nobody questions the efficiency of these huge markets; but their lack of resilience has also been amply demonstrated, for instance during the Asian crisis of the late 1990s, and dozens of other monetary crashes. In short, our global network of monopolistic national moneys has evolved into an overly efficient and dangerously brittle system. This system's lack of resilience shows up not in the technical field of the computer networks (which all have backups), but in the financial realm. Such a crisis, particularly a

[4] "Liquidity" and "Depth" of a financial market refers to the possibility of moving large volumes of money without significantly affecting prices. In a deep market, a lot of people are buying and selling. By contrast, in a thin market, because fewer people are trading, even one single large transaction could significantly affect prices.

combined monetary and banking crash, is - other than war - the worst thing that can happen to a country.

Even more ironically, whenever a banking crisis unfolds, governments invariably help the larger banks to absorb the smaller ones, believing that the efficiency of the system is thereby further increased. This make banks that are "too big to fail" into still bigger ones, until they become "too big to bail". This whole process is illustrated in Figure 4.

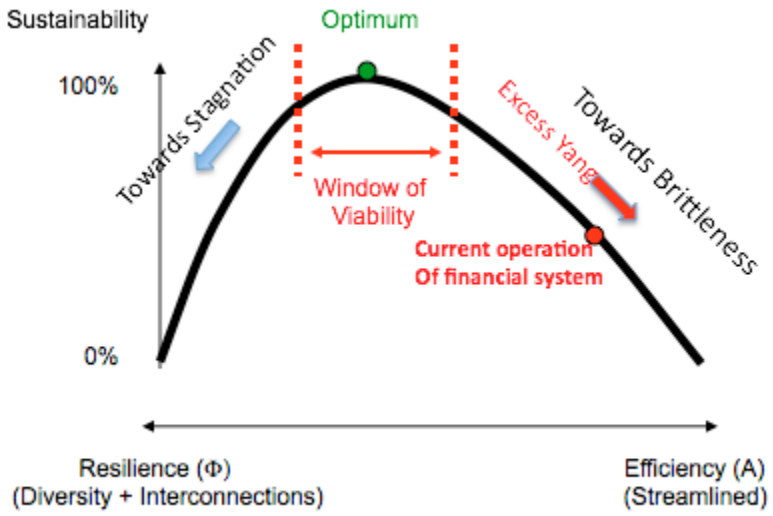

Figure 4: Today's global monetary ecosystem is significantly overshooting the Window of Viability because of its exclusive emphasis on efficiency. It is careening toward brittleness and collapse because a general belief prevails that all improvements need to go further in that the same direction (thick downward arrow) of increasing growth and efficiency. For instance, the global monoculture of bank-debt money as legal tender is technically justified on the basis of efficiency of price formation and exchanges within each country. Internationally, floating exchanges were also justified because they are "more efficient". This is part and parcel of how we are building up an "Excess Yang" deviation.

Similarly, the substance that circulates in our global economic network – money – is also maintained as a monopoly of a single *type* of currency: bank-debt money, created with interest. Imagine a planetary ecosystem where only one single type of plant or animal is tolerated and artificially maintained, and where any manifestation of successful diversity is eradicated as an inappropriate "competitor" because it would reduce the efficiency of the whole.

An overly efficient system as the one described in Figure 4 is "an accident waiting to happen", condemned to a sudden crash and collapse however many competent people dedicate time and heroic efforts to try to manage it. After a collapse, in both natural ecosystems and in monetary systems, the same process takes over. Let us take as example the most extreme cases of total systemic meltdown. For instance: a massive fire that burns a forest down to ashes; or a complete meltdown of a financial system.
In the monetary domain this happened in Germany in the 1920s and again at the end of World War II, in the United States during the "bank holidays" of the Great Depression, or in Argentina in 1999-2002. All these have in common to be simultaneous monetary and

banking crisis. A dollar crash would again make this phenomenon part of our close future.

Fortunately, most crises are less extreme than that. However, going through the exercise of exploring such a "pure" extreme gives some ideas of the power and depth of the dynamics that are involved. Less extreme crises simply manifest only some of the features of the process we will describe now. Just like a partial forest fire, one that doesn't reduce everything to ashes, manifests only some of the attributes of a total burnout.

The process of a collapse shows up graphically with a drop of sustainability to close to 0%. (see Figure 5) The next step after a total meltdown is an extreme fragmentation, without much collaboration. In a forest, this takes the form of seedlings of any type trying to sprout randomly. At the extreme, in a financial system, this takes the form of a return to primitive barter: i.e. survival exchanges without any standardization or organization. This stage can be seen as the case when each participant uses whatever he or she has as a commodity currency.
The next step is the emergence of a multitude of "survival organizations", that start to introduce some standards and some informal agreements on dates and places where the exchanges take place. In Argentina this took the form of the multiplication of local exchange mechanisms, under the names of "*ruedes de trueque"* in which locally issued *creditos* currencies were used as medium of exchange in weekly neighbourhood markets. Assuming that the designs of these systems were sound (which unfortunately wasn't the case in Argentina), then the better systems would tend to emerge as models for others, and gradually more efficient exchange systems would evolve. Over time, a more diversified and more interconnected economy would rebuild, which would return the system back into the zone of the Window of Viability.

Graphically, this whole process is illustrated in the next illustration (Figure 5).

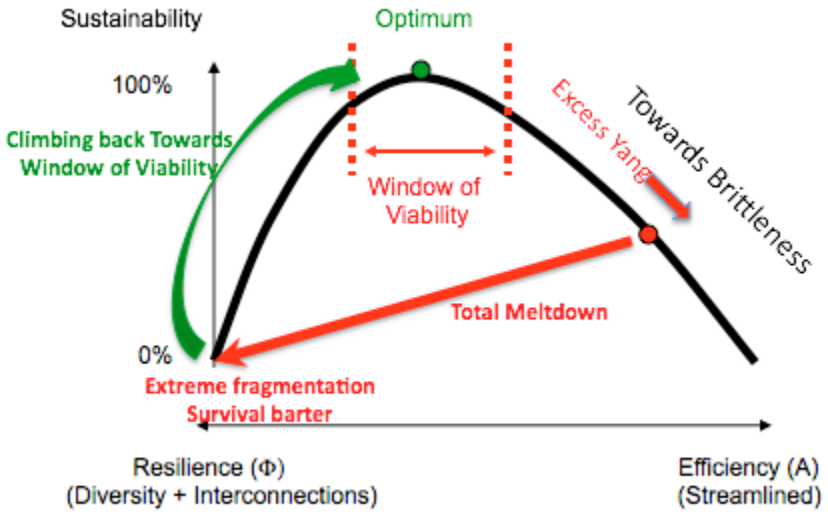

Figure 5: Dynamics of a total collapse and natural recovery of a complex flow-network. First, extreme fragmentation takes places, without any efficiency. In a natural ecosystem, all kinds of species try to emerge; in the case of an economy this takes the form of survival

barter where everything is used as currency. In natural ecosystems, the recovery sees the less inefficient species starting to thrive, and together they generate an ecosystem operating within the Window of Viability.

In Modern monetary practice, however, what has invariably happened until now is that as soon as possible, under the ideology of monetary orthodoxy and as a result from bank lobbying, a monopoly of bank debt money as the only medium of exchange is re-established back as before. This took place for instance in Germany in the 1920s and in the US in the 1930s, when all the "emergency currencies" were outlawed; or in Argentina through a massive falsification of *credito* paper currencies.
However, we now know that such a monoculture is not a sustainable structure in the long run, so that such a return to "normalcy" is in fact overshooting again the window of sustainability. As a consequence, we are getting back on the next cycle of pushing for more efficiency within a monoculture environment, which will lead to the next crash a few decades later.
This process is illustrated in Figure 6.

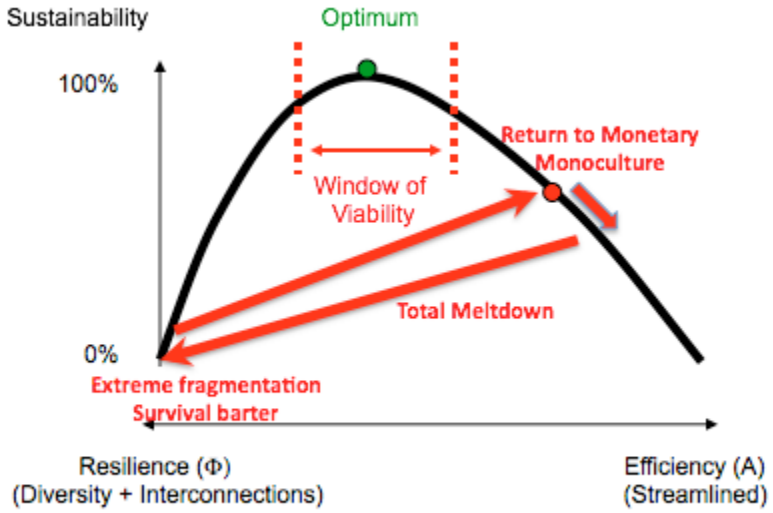

Figure 6: Under the pressure of the monetary orthodoxy and powerful lobbies, the monopoly of bank-debt money as medium of exchange is re-established. This brings the system back to the situation described in Figure 4. The autocatalytic pressures in such a monoculture will tend to gradually push the system towards more excessive efficiency and its next crisis, as soon as memories of the previous one has started to fade…Of course, in natural ecosystems, such a systematic, repetitive and artificial human intervention isn't taking place, and natural systems follow normally the dynamic of figure 5.

As stated earlier, nature has over billions of years selected the conditions under which complex ecosystems are sustainable, otherwise they wouldn't exist today. In contrast, humanity still struggles with the issue of how to create sustainable economies. We know that the same theoretical framework applies to both natural and man-made complex systems. Given the structural nature of the key variables, two complex flow networks with the same structure will have identical behavior patterns...
We have been going through this loop many times by now. To be precise, according to IMF data, since the 1970s there have been no less than 145 banking crises, 208 monetary crashes and 72 sovereign debt crises: a staggering total of 425 systemic crises, an average

of more than ten per year! (Capri & Klingebiel,1996; Laevan & Valencia, 2010). These crises have hit more than three-quarters of the 180 countries that are members of the IMF, many of them several times. How many more crises do we need before humanity is willing to learn that this is a systemic issue, and that only structural changes will avoid repeating the same patterns.

A Structural Monetary Solution

A full inventory of the options on how to deal with a systemic banking crisis has been explained in another paper (Lietaer, Ulanowicz & Goerner, 2009).

Conventional economic thinking assumes the *de facto* monopolies of national moneys as an unquestionable given. In contrast, the clear lesson from nature is that systemic monetary sustainability requires a diversity of currency systems, so that multiple and more diverse agents and channels of monetary links and exchanges can emerge.

It is important to realize that another way is available to get back towards the window of vitality than waiting for a total crash. That other way is to let complementary currency system grow, or even encourage the soundest of them to blossom, and gradually and gently push back the excesses of the monoculture, as seen in Figure 7. This task is what this international journal of community currencies research is in the business of studying and promoting.

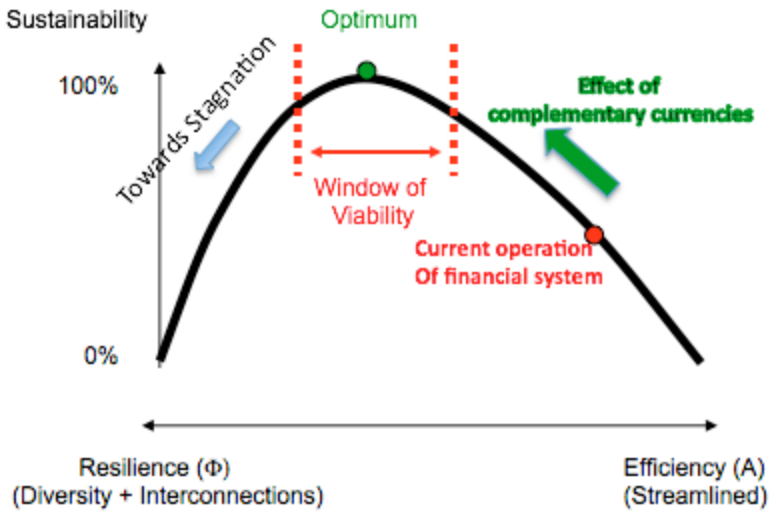

Figure 7: The Effect of Diverse

Complementary Currencies

The operation of complementary currencies of diverse types enables the economy to flow back towards greater sustainability (thick upward arrow). While this process clearly reduces efficiency, that is the price to pay for increased resilience of the whole. Complementary currencies facilitate transactions that otherwise wouldn't occur, linking otherwise unused resources to unmet needs, and encouraging diversity and interconnections that otherwise wouldn't exist.

Conventional economists are correct when they claim that a diversity of media of exchange is less *efficient* than a monopoly. However, it has now been proven that such a drop in efficiency is the necessary cost for increasing the *resilience* of the economic system.
At the other extreme, some complementary currency enthusiasts claim that we should expect and encourage very large numbers of complementary currency systems, even that each person could start issuing his or her own currency. This could rise their numbers to the millions. A warning can and should now be issued: at a certain point we risk overshooting the Window of Viability in the other direction, and the result would be stagnation.

1. At the present time, that risk is obviously less imminent that the possibility of repression of some complementary currencies that become "too successful" in the eyes of some conventional central bank authorities. In that respect, it is clearly very encouraging that at least one central bank has officially come to the conclusion that social currencies are not a threat to monetary policy, but actually contribute to the building of social capital and to the reduction of poverty (Freire, 2009). Furthermore, we now have also empirical proof from 75 years of data from the WIR system in Switzerland that business-to-business complementary currencies actually help central banks in their task of stabilizing the national economy in terms of employment and in smoothing the swings in the business cycle (Stodder, 1998, 2008, 2010). In a period when unemployment, poverty and economic exclusion are all increasing in the developed world, it would be important that central banks revisit this issue with a more open mind than has been the case so far...

Policy Implications

Ironically, our financial system has become so fragile because it has become too efficient. To achieve hight efficiency, our modern monetary system is streamlined to a monoculture of a single type of money. This monoculture is legally imposed in the name of market efficiency. Furthermore, governments enforce this monopoly by requiring that all taxes be paid exclusively in this particular type of currency.

Wc claim that making the monetary system sustainable will require a new balance between efficiency and resilience in economics, in a way similar to what occurs naturally in ecosystems. Humanity has become, involuntarily and reluctantly, the steward of this planet's biosphere. Ultimately, we have no choice but to learn how to make our global civilization sustainable, or it will cease to exist.
It may be useful to remember here that Albert Einstein defined insanity as doing the same thing over and over again and expecting different results..

Next Steps?

The most valuable role for government in implementing the approach proposed here could limit itself to specifying the kind of currency other than conventional bank-debt national money it would accept in payment of fees and taxes. Interestingly, Uruguay has been the first country to follow precisely such a strategy by accepting an electronic business-to-business generated currency called C3 (for Commercial Credit Circuit) for all payments of fees and taxes, in addition to the conventional national money. Their

reasoning: it is a very effective way to increase employment through the small and medium-sized enterprises (which represent over 90% of private employment in that country), because it provides working capital to the participating businesses without costing anything to the government. A bank plays the role of converting the C3 units into national currency when requested, at a cost borne by the participating business making that request .More information about this example, and other complementary currencies already operational today, that this journal has been documenting for over a decade.

The trillion dollar question becomes therefore: how many more banking and monetary crashes do we have to live through before we have the humility to learn from nature in this domain? Could it be that governments may have to learn from the next crisis that they can't afford to save the banking system?

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