



Analysis

The Ecology of Money: A Critical Assessment

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ABSTRACT

This paper assesses the proposal to transform the monetary system into an Ecology of money, that is, into a system made of a large diversity of complementary currencies. Its central aim is to examine whether this proposal could provide a systemic solution to both the ecological and financial crises, as several authors, most notably Lietaer and Douthwaite, have argued. To this end, it analyses the two main arguments in favour of this proposal. First, it focuses on the claim that an Ecology of money would be more resilient and less prone to crisis than the present monetary system. It shows that this argument suffers from several conceptual flaws and argues that it fails to provide sufficient normative reasons to favour an Ecology of money. Second, this paper analyses the claim that an Ecology of money could help defeat the monetary growth imperative that supposedly plagues our economies. The paper raises serious doubts about the existence of such an imperative and questions the claim that an Ecology of money could contribute to weaken it in a significant way.

1. Introduction

The last decade has seen the world increasingly hit by two damaging crises. First, there is now large empirical evidence that the ecological crisis is affecting every part of the world (Rockström et al., 2009; Steffen et al., 2015). The world has also suffered from a dramatic financial and monetary crisis, which spread all over the world and exposed the fragilities of governments' finance and the incapacities of state authorities to handle monetary policy and banking supervision in an efficient way (Pettifor, 2017; Turner, 2016). A growing literature in ecological economics is attempting to bridge the gap between these ecological and economic challenges. Several authors have for long warned that constant economic growth is leading to the depletion of natural resources and is putting an excessive strain on environmental sustainability (Daly, 1990; Georgescu-Roegen, 1974; Jackson, 2016). More recent attempts focus on building up ecological macroeconomic models that can account for these phenomena (Fontana and Sawyer, 2016; Rezaei and Stagl, 2016; Victor, 2008). Part of the literature is also concerned with finding ways to weaken the strain of economic development on natural ecosystems: some argue for sustainable growth (Solow, 1993; Stiglitz, 1997) while others reject that concept altogether and defend de-growth or a stationary state instead (Martínez-Alier et al., 2010).

This paper contributes to this latter part of the literature by analysing one proposal that, according to its proponents, could provide a systemic solution to both the ecological and financial crises. This proposal has been called the "Ecology of money", following the work of Douthwaite (2000, 2012), and of Lietaer et al. (2009, 2010, 2012).¹ Their core idea is that one of the root causes of both crises lies in a lack of monetary plurality and that one key solution to these crises would be to implement an "Ecology of money". They argue that the monetary system should be transformed so as to induce a large diversity of actors (banks, states, citizens, ...), within each monetary area, to create multiple complementary currencies. These could span from local, regional and national currencies to Local Exchange Trading Systems, Barter systems and small-scale social currencies (Douthwaite, 2000, chap. 5; Lietaer et al., 2012).

This proposal is part of a recent trend that analyses how new forms of money could contribute to tackle environmental challenges. Several authors have stressed that small-scale complementary currency schemes could have several potential benefits for sustainability (Brooks, 2015; Seyfang and Longhurst, 2013) or for social cohesion (Guéorguieva-Bringuier and Ottaviani, 2018; Oliver Sanz, 2016), even though recent empirical research found no significant empirical evidence of such effects (Marshall and O'Neill, 2018; Michel and Hudon, 2015). Lietaer's and Douthwaite's proposal is more radical and aims at

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¹ Lietaer collaborated with several co-authors, most notably, Christian Arnspenger, Stefan Brunnhuber, Sally Goerner and Robert Ulanowicz. However, he remains the chief proponent of that proposal.

the large-scale adoption of complementary currencies. It has become a standard focal point in discussions around the desirability of complementary currencies (Attout et al., 2013; Dron, 2015; Joachain and Klopfer, 2012). However, there is, to my knowledge, no academic discussion of that proposal. The academic literature on monetary plurality focuses either on the history of past episodes of plurality (Fantacci, 2005; Kuroda, 2008), or on the study of present small-scale experiments (Blanc, 2018; Gómez, 2018). This paper is an attempt to fill this gap. It examines the link between monetary plurality and sustainability in a systematic way, and inquires whether having a plurality of currencies circulating in parallel to each other is necessary for creating a stable and sustainable human society. To this end, the paper analyses thoroughly the main arguments that Douthwaite and Lietaer and his co-authors have put forward in favour of their proposal.

Section 2 focuses on their first main argument. Citing the work of Fisher (1935) and Minsky (1986), both authors argue that the current monetary system has an inherent tendency to instability, as bank money tends to be too abundant in times of booms and too scarce in times of crisis (Douthwaite, 2000, chap. 1, 2012, p. 192; Lietaer et al., 2012, pp. 94–95). They claim that, similarly to natural ecosystems, a more diverse monetary system would be more resilient to economic and financial shocks, and, therefore, more stable. Section 3 examines their second main argument. Lietaer and Douthwaite argue that a more diverse monetary system would contribute to weakening the so-called monetary “growth imperative” that allegedly plagues our economies (Douthwaite, 2000, chap. 1; Lietaer et al., 2012, chap. 5). Presently, the greatest part of the money supply is made of the sum of all credits issued by private banks (McLeay et al., 2014). Alongside Douthwaite and Lietaer, a growing number of researchers is claiming that this credit-based creation process triggers a growth spiral (Farley et al., 2013; Kuzminski, 2013; Loehr, 2012), though critics argue that this growth imperative is much exaggerated or even non-existent (Richters and Siemoneit, 2019; Strunz et al., 2017). Lietaer and Douthwaite argue that implementing an Ecology of money would slowly weaken that growth imperative by gradually replacing bank money by interest-free complementary currencies. In addition, Douthwaite also advocates the creation of a single “energy-backed” currency, to which every currency belonging to the Ecology of money would be connected. Its creation would be limited by the availability of CO2 emission permits, so as to reduce environmental degradation and discourage growth (Douthwaite, 2000, chap. 5).

Alongside these two central arguments, Lietaer and Douthwaite raise several other complaints against bank money. Lietaer, in particular, argues that it threatens social cohesion, increases wealth inequalities and fails to take future outcomes properly into account (Lietaer et al., 2012, pp. 103–114). However, these worries are less central to their argument and do not necessarily relate to a lack of monetary diversity. Many complementary currencies, such as some government-sponsored currencies and most private currencies, do not give users or participants a say in the decision-making process (Blanc, 2018). Moreover, the impact on wealth inequality or social cohesion of complementary currencies is far from obvious (Marshall and O'Neill, 2018; Michel and Hudon, 2015). I leave these points aside, as we may have doubts that an Ecology of money would help solving these issues.

Section 4 summarizes the main findings of the paper. On the one hand, this article argues that the analogy between monetary and ecological ecosystems is far from evident and fails to provide sufficient normative reasons to favour an Ecology of money. On the other hand, we may question whether getting rid of the monetary growth imperative necessarily requires implementing an Ecology of money.

2. Ecology of Money and Stability

2.1. Presentation of the Argument

According to classical definitions, such as Tobin's (2008), a currency

is a medium of exchange with a unique denomination, that relates to a unique standard of value, but which might take several forms as a means of payment (notes, coins, etc.). For instance, the euro, the dollar and the Bristol pound are all examples of currencies: even if they may take various forms as means of payment, they have a unique denomination and the value of one unit of these currencies is the same for any unit at a given moment in time.

Under Lietaer's scheme, the present monetary system would be complemented by a myriad of parallel currencies (Lietaer et al., 2009, pp. 10–12). These include Local currencies, which circulate within a confined geographic area, and Local Exchange Trading System (LETS), a type of mutual credit system. It also includes complex projects, involving both civil society and governments. The NU-project in the Netherlands, the WIR in Switzerland, or the French SOL belong to this latter category. Finally, Lietaer's Ecology of money would also involve commercial currencies, such as Air Miles. According to that scheme, any actor (businesses, towns and local communities, as well as states, regions and municipalities) would be free to create its own currency (for a more exhaustive review, see Lietaer et al., 2012, chaps. 7–8).

Douthwaite defines his own version of an Ecology of money as consisting of a large array of currencies, organized in a structured way (Douthwaite, 2000, chap. 4). At the top, there would be an international currency functioning like a modern Gold standard (with Gold replaced by CO2 emission rights). This would be complemented by national, regional and local currencies, as well as by “store-of-value” currencies, for those economic agents who would wish to have a safe haven for their wealth. Douthwaite imagines a complex set of exchange mechanisms to manage this large diversity of currencies. Douthwaite's proposal has one key difference with Lietaer's proposal: the existence, at the top of the monetary pyramid, of an “energy-backed” currency. Douthwaite argues that tying money creation to a scarce resource may restrain economic growth. This difference has no consequence on the present argument. However, as we shall see in section 3, it does have some implications for the growth imperative argument.

Both authors contend that an Ecology of money would make our current monetary system more stable and less prone to crisis (Douthwaite, 2000; Lietaer et al., 2012). Douthwaite argues – without reference to the economic literature on the subject, though – that the present economic system is inherently unstable: excessive amounts of money are created in times of booms, and too little in times of recession (Douthwaite, 2000, chap. 1). He then argues that his Ecology of money would be less prone to crisis than conventional monetary systems (Douthwaite, 2000, chap. 4). According to his argument, regional and local currencies can be viewed as fall-back mechanisms in times of crisis. He takes the example of Britain's economic disparities in the 1980's, when London was booming while Manchester was in recession. Though Douthwaite says nothing about the cause of these economic disparities, he argues that having regional currencies in parallel to the Sterling Pound would have allowed to stabilize Britain's economy, by giving the opportunity to Manchester's authorities to create the appropriate amount of money (Douthwaite, 2012, pp. 191–192).

Lietaer and his co-authors have developed this argument in much greater detail, and I therefore mainly focus on their version of the argument in the remaining of this section. They share Douthwaite's view that our economic system is unstable, and plagued by constant “booms” and “busts”. They take this to be an obvious fact, supported empirically and in theory by the work of Minsky (1986), Fisher (1935) and others (see Lietaer et al., 2012, p. 95 for more references), though they do not discuss the connection between their argument and the diverse theories of these authors. They then argue that their proposal would make our current monetary system more stable through a right balance of efficiency and resilience. According to Lietaer et al. (2009), these concepts find their origin in scientific ecology, namely in the works of May (1972) and of Holling (1973). However, their interpretation of these concepts is rather superficial, and does not clearly relate to the works of these authors. According to Lietaer et al. (2012, p. 78) efficiency, or

throughput efficiency, “measures the ability of a system to process volumes of the relevant matter-flow, energy-flow and/or information-flow”. They supposedly borrowed this concept from May (1972), though May himself does not mention it. Resilience, on the other hand, “measures the ability of a system to recover from a disturbance” (see also Goerner et al., 2009, p. 77). According to Lietaer and his co-authors, that concept is inspired by the work of Holling (1973). However, what they call “resilience” does not correspond strictly to Holling’s own definition, and may rather relate to his concept of “stability”, which indicates “the ability of a system to return to an equilibrium state after a temporary disturbance” (Holling, 1973, p. 14). For Holling, resilience points to another concept, namely, “the measure of the persistence of systems and of their ability to absorb change” (Holling, 1973, p. 14).

Lietaer’s argument is that stability is attained when the optimal balance between efficiency and resilience prevails (Lietaer et al., 2012, p. 79). The key parameter connecting them is “diversity”. On the one hand, increased diversity enhances resilience “because there are numerous channels of interaction to fall back in times of trouble” (Lietaer et al., 2012, p. 78; see also Douthwaite, 2012, pp. 191–192). On the other hand, efficiency tends to decrease with diversity. A more diverse system may become more complex to engineer and, therefore, less efficient. In short, they argue that there is a trade-off between resilience and efficiency: the more a system is resilient, the less it is efficient, and vice-versa. Unfortunately, Lietaer and his co-authors do not specify precisely when optimality is achieved, and do not provide a precise criterion to measure how resilient, efficient or stable a given system might be. Conceptual vagueness may sometimes be fruitful, especially for interdisciplinary communication (Strunz, 2012, p. 115). However, as we shall see in the next sections, it also poses several problems regarding both the empirical evaluation and the normative relevance of a theory (Strunz, 2012, p. 114).

Lietaer et al. (2009, 2010, 2012) argue that natural ecosystems that are more diverse are also more stable and resilient: the diversity of their constituent elements allow them to attain the optimal balance of resilience and efficiency. By analogy, they conclude that only monetary plurality can provide the optimal balance of resilience and efficiency. A larger diversity of currencies could provide a larger array of tools for effectively responding to shocks in times of crisis. And an Ecology of money would be better able to respond to turmoil because reliable currencies would replace defective ones in times of crisis. Moreover, they share Douthwaite’s intuition that such a system would be less likely to be hit by a financial or monetary crisis, because it would be less dependent on one single currency.

Before analysing Lietaer’s argument in detail, let me stress why it makes sense to phrase it as an analogical argument. Lietaer and his co-authors are ambiguous on this regard. On the one hand, they write that “[our argument] is relevant for any network of a similar structure, therefore the applicability to an economic network is not simply an analogy, but a direct application of the theoretical framework described above” (Lietaer et al., 2009, p. 9). On the other hand, their writings are pervaded by analogies between natural and economic systems. Actually, the sentence just before the one quoted above uses an analogy: “In this view, money is to the real economy like blood is to your body: it is an essential vehicle for catalyzing processes, allocating resources, and generally allowing the exchange system to work as a synergetic whole.” (Lietaer et al., 2009, p. 9). In the same paper (p.7), they write: “Plants capture the sun’s energy with photosynthesis; animals eat the plants; species then eat each other in a chain to top predator (...). Similarly, economies are circulation networks consisting of millions of businesses and billions of customers (...).” Later, they conclude that “nature has over billions of years selected the conditions under which complex ecosystems are sustainable (...). We know that the theoretical framework applies to both natural and man-made complex systems. Has the time not come to learn in this domain from nature?” (p.10). These are clear examples of arguments by analogy (Bartha, 2016). Lietaer cites similarities between the two systems (i.e. their diversity) and then

concludes that some further similarity exists (i.e. their resilience and stability).

Apart from these many examples of analogical reasoning, one should note that the concepts they are using are borrowed and adapted from scientific ecology, and then applied to economic systems (see above). Moreover, most of the support that they might get for their claims comes from scientific ecology. Therefore, it makes sense to appeal to an analogical argument in order to strengthen and then criticize their argument.

2.2. Logical Validity

Let us take Lietaer’s argument as a starting point. Is this argument valid? Does the analogy between natural and monetary ecosystems make sense? What are its strengths and its weaknesses?

Philosophers of science have sought to establish criteria to evaluate the strength of analogical arguments (for a review, see Woods et al., 2000). I will use the framework of Hesse (1967), as presented in Bartha (2016), who emphasizes three prerequisites for a good analogical argument. First, the analogy must concern observable similarities. Second, the explained relation must be causal. Third, the compared elements must not have “essential” differences. What counts as “essential” is open to debates (see Bartha, 2016). On the one hand, the compared elements should of course not be identical, otherwise it would make no sense to compare them. On the other hand, for comparison to make any sense, these elements should have some key properties in common. In our case, we will have to find out what monetary and natural ecosystems may have in common.

2.2.1. Observable Similarities

Does Lietaer’s argument, as presented in the previous section, respect the first condition? The diversity, resilience and stability of natural ecosystems are observable properties and there is a large literature in ecology on the subject (e.g. Zommers and Alverson, 2018). Similarly, one can assess the stability of existing monetary systems and study how they react and recover from shocks (Acemoglu et al., 2015; Haldane and May, 2011). However, the resilience and stability of monetary systems that would respect Lietaer’s proposal is harder to observe. On the one hand, as we have seen in the previous section, Lietaer and his co-authors do not provide a clear criterion that would allow to assess whether a system is resilient or efficient. However, even assuming that one has a suitable concept of resilience or efficiency, a further problem is that their proposal has not been applied on a large scale yet. If it was implemented, one could of course observe how a diverse monetary system would work, and whether it is resilient and stable. However, nothing close to such a system has yet seen the light, even if past experiments of monetary plurality are well-documented. Fantacci (2005), Gómez (2018) and Kuroda (2008), among other authors, have studied in depth examples of successful instances of monetary plurality. However, these authors do not attempt to justify these experiments, nor do they argue for a modern implementation of similar ideas. Moreover, the examples they study are not discussed by Lietaer, and do not necessarily relate to his proposal.

In support of their ideas, Lietaer and his co-authors rather refer to the WIR, which, according to them, provides a suitable illustration of their proposal. The WIR is a Swiss complementary currency that is deemed to have contributed to Swiss economic stability (Stodder, 2009; Vallet, 2016). Lietaer et al. (2009, p. 1) even claim that “formal econometric analysis has proven that the WIR acts as a significant counter-cyclical stabilizing factor that explains the proverbial long-standing stability of the Swiss economy.”

One could ask, first, whether the WIR does really provide an illustration of what an Ecology of money might look like. The WIR is a complementary currency, which small and medium enterprises (SME’s) can use to exchange goods and services (in Switzerland). WIR assets are generated by credits from the WIR Bank. As Stodder (2009, pp. 80–81)

explains, exchanges in WIR take the form of trade credit: when an exchange in WIR takes place, the account of the firm that sells a good is credited of a given amount while the account of the buyer is debited of the same amount. The WIR circulates along the Swiss Franc, but is not redeemable in Swiss Franc. However, both Lietaer and Douthwaite make clear that their proposal would involve a large array of different currencies – not only two. The example of the WIR is thus far from an ideal illustration of their proposal.

Second, if we nevertheless assume that it does provide an appropriate real-world illustration of their proposal, one can still wonder whether it supports Lietaer's claim that diversity increases resilience. Does Lietaer's theory really explain the WIR success? Stodder (2009) and Vallet (2016) argue that the WIR has had a counter-cyclical effect in times of crisis, especially for small and medium enterprises. In turbulent times, members of the WIR tend to compensate for the loss in sales in CHF by a rise in sales in WIR. However, contrary to what Lietaer et al. (2009) claim, they do not go as far as saying that the existence of the WIR explains overall Swiss stability. Stodder (2009) makes clear that, while he found a statistically significant counter-cyclical effect of the WIR on the Swiss economy, that effect is rather small and does not constitute the main explaining factor of Swiss stability (see also Blanc, 2018, p. 99).

The existence of “fall-back” currencies may indeed constitute a valuable mechanism for economic stability. There is thus a case to be made for currencies that, like the WIR, may contribute to stabilizing the economy. However, we may have doubts that the WIR experiment may be replicated elsewhere. Attempts to create similar currencies in Belgium (RES) or in Sardinia (Sardex) have not achieved any significant effects (Blanc, 2018). This may be explained, in part, by the WIR's particular traits. Stodder (2009) stresses the importance of the WIR's inherent characteristics (its solidity as a mutual trade credit scheme, mainly). Vallet (2016), who has conducted interviews among the WIR community, concludes that mutual trust and a spirit of cooperation among WIR participants explain the WIR's success. Moreover, the WIR is still extremely marginal compared to the Swiss Franc and it remains to be seen whether scaling it up would be possible (Stodder, 2009). Further research needs to be done in that area. In particular, more quantitative studies would be required to show how the WIR has contributed to Swiss' macroeconomic stability.

Therefore, despite its many virtues, the WIR is unlikely to provide an illustration and an argument in favour of Lietaer's proposal. On the one hand, the interactions between the WIR and the Swiss Franc are still very far from what Lietaer has called an Ecology of money. On the other hand, the factors explaining the WIR success do not relate to Lietaer's claim that diversity leads to resilience. Stodder (2009) and Vallet (2016), who have conducted the most in-depth studies of this currency, both emphasize the role of the WIR's inherent traits in explaining its success but do not mention diversity or resilience as explaining factors of the WIR's effect on stability.

2.2.2. Causal Relations

The second requirement is that the analogy should concern causal relations. Lietaer claims that there is a causal link between the diversity and resilience of natural ecosystems, and between their resilience and their stability. Increased diversity leads to increased resilience, which in turn ensures greater stability. Using an analogical argument, he contends that a monetary system consisting of a large diversity of currencies will increase resilience and converge towards something similar to a stable natural ecosystem.

In ecology, an immense literature studies the relationship between diversity and stability. In their review article, Ives and Carpenter (2007) show that most empirical studies confirm the expectation of a positive relationship between diversity and stability (but not all). However, these studies use numerous different concepts of stability, and none of these definitions refers to the optimal balance of resilience and efficiency (which is Lietaer's definition). In fact, as we have seen in section

2.1, the definition used in Lietaer et al. (2009, 2012) lacks support in ecology and relies on a superficial interpretation of Holling's work (1973). It may, therefore, be hard to assess whether that literature supports Lietaer's claims.

Moreover, Ives and Carpenter (2007) show that there exist numerous possible theoretical explanations of this phenomenon, which often contradict each other. Their key point is that there is, for now, no generally accepted theory of the diversity-stability relationship (Ives and Carpenter, 2007, p. 61). Among potential theoretical explanations, some do predict that diversity leads to stability through increased resilience, but not all. The authors do stress that some empirical studies show that, when species respond differently to environmental shocks, increasing diversity often makes the system more resilient and, therefore, more stable, because a decrease in population for some species is counterbalanced by an increase in population for others. However, there exist several counter-examples, such as instances of resilient but unstable ecosystems. Holling, for instance, shows that, in some parts of Canada experiencing extreme climatic conditions, insect populations fluctuate constantly and widely, without returning to an equilibrium state after disturbance. However, they are perfectly able to react to climate shocks. Holling concludes that they are thus resilient but unstable (Holling, 1973, pp. 17–18). Finally, several theoretical explanations of the positive relationship between diversity and stability do not rest on resilience. The explaining factor can also be resistance to shocks, the effects of competition between species, or relative isolation (Ives and Carpenter, 2007).

In short, one can have doubts that Lietaer's interpretation of the relationship between diversity and stability in ecology is the right one. There is a relative consensus in ecology about the positive relationship between diversity and stability. However, Lietaer's concept of stability does not relate to any of those that are used in the mainstream literature in ecology. Moreover, the relationship might be explained by a causal mechanism that is different from Lietaer's, without any mention of resilience.

2.2.3. Non-Essential Differences

Recall that the third requirement for a “good” analogical argument is that the compared elements must not have “essential” differences. What exactly amounts to a “non-essential” difference is open to debate (see Bartha, 2016). In this paper, I shall interpret it quite broadly as meaning that the elements of comparison should have some key properties in common, such as a common pattern of behaviour or of interaction. Let me illustrate this point in relation to Lietaer's analogical argument. How much do natural and monetary ecosystems have in common?

Prima facie, it is hard to see what currencies and natural elements have in common. Currencies are social constructs, which depend on what people do with them and think of them (Searle, 1995). Their existence relies on their acceptance by a large number of users (Tobin, 2008). Moreover, contrary to nature, these social constructs are relatively recent and have not undergone any severe natural selection processes (Haldane and May, 2011). Currencies are protected by governments, which can force people to use them.

Nevertheless, Lietaer and his co-authors introduce two possible key common properties that may be shared by money and natural elements alike. They argue that natural and monetary ecosystems are both complex systems and that their aim is to provide certain functions. For instance, they write that “viewing economies as flow systems emphasizes directly money's primary function as medium of exchange. In this view, money is to the real economy like blood is to your body: it is an essential vehicle for catalyzing processes, allocating resources, and generally allowing the exchange system to work as a synergetic whole.” (Lietaer et al., 2009, p. 9).

Money does have several functions (Tobin, 2008). Similarly, ecosystems render multiple services to humans, from gas and climate regulation to waste treatment and food production (Costanza et al.,

1998; De Groot et al., 2002). However, one can doubt that this is an adequate way to compare natural and monetary ecosystems. While it is undeniable that money is used and created in order to provide certain functions, one cannot argue with the same ease that the *purpose* of nature is to render these ecosystem services. Contrary to monetary ecosystems, it is much more controversial to contend that natural ecosystems have been “designed” or “created” for these purposes. The thesis that nature has a purpose (or a design) has been forcefully contested since at least Darwin's revolutionary work (Kitcher, 2009).

Therefore, natural and monetary ecosystems do share some key properties: they are both complex systems. However, there is at least one key difference between natural and monetary ecosystems. Natural ecosystems react to shocks without any intent. The order of nature is spontaneous and not designed. On the contrary, when a shock hits a monetary system, multiple actors will coordinate to find the adequate response to it. Economic actors do exhibit some instinctive or emotional reactions to shocks, especially in the financial sphere (Shiller, 2012). However, the reactions of private banks, central banks and government bodies cannot be described as purely instinctive, as there are also the result of complex coordination processes (Elster, 2007).

This latter point has serious implications for my argument. If taken seriously, Lietaer's proposal appears to rely on the belief in spontaneous (monetary) order, a concept that was first forged by von Hayek (1945), whose influence is acknowledged by Lietaer (e.g. Lietaer et al., 2009, p. 13). An Ecology of money would in practice involve a great number of different currencies. Each of them would be linked to a community, a private firm, a state, or an informal group of individuals. Lietaer claims that the result of their interaction would be harmonious and stable. Harmonious because all currencies will “fit together” so that the monetary system will reach equilibrium without central intervention. Stable because the system will be able to react resiliently to external shocks. As we have seen, in times of crisis, reliable currencies will “spontaneously” replace “failed” ones.

Of course, there are several important differences between von Hayek's and Lietaer's proposals. von Hayek (1990) proposed to get rid of all banking regulations, whereas Lietaer argues against deregulation (Lietaer et al., 2012, pp. 45–48). von Hayek is reliant on the capacity of competition to produce an efficient outcome, while Lietaer leaves space for the state and other central agencies to play the role of regulators. Nevertheless, Lietaer is extremely unclear concerning how an Ecology of money would work in practice. Nothing is said on how different currencies would interact, whether they would be convertible into one another, and how the hierarchy between international, national, regional and local currencies would work.

Thus, will Lietaer's scheme (or Douthwaite's) be able to reach stability? At first sight, a system made of multiple different kinds of currencies circulating in parallel to each other may seem very complex to manage. Lietaer's scheme raises numerous unanswered questions. How would exchange rates be fixed? Will all currencies be convertible into each other? Who will make sure that monetary creation will neither be too abundant nor too restrictive, in a system with potentially hundreds of parallel currencies? What may guarantee that agents will not hoard certain currencies (the “good” ones), and spend others (the “bad” ones), thus producing unintentionally the worse consequences of Gresham's Law? Lietaer and his co-authors offer no answers to these questions.

Having a look at past experiments of monetary plurality may be helpful here. As Fantacci (2005), Kuroda (2008) and others have pointed out, the past centuries are filled with examples of successful cohabitation between different currencies. Free banking, as experienced in Scotland or the English colonies, may also provide an interesting example (White, 1984). However, the episodes of monetary plurality studied by Fantacci and Kuroda may be difficult to compare with Lietaer's proposal. First, because Lietaer is not at all clear on what his proposal would look like, and, second, because these experiments often involved currencies that no longer exist and that have not much in common with complementary currencies. Concerning Free banking,

historians and economists have raised serious doubts regarding its efficiency and alleged success, with opinions ranging from serious concerns (Bordo and Schwartz, 1995) to quick dismissal (Rothbard, 1988). The existence of these past experiments does show that monetary plurality is possible. However, no conclusive answer regarding the potential success of Lietaer's scheme can be drawn from these past episodes.

To sum up, we can have serious doubts about the capacity of the analogical argument to support the Ecology of money proposal. First, and contrary to what Lietaer and his co-authors argue, the WIR example (despite its inherent qualities) does not provide an empirical confirmation of their theory. Second, Lietaer's arguments and mainstream studies in ecology do not make use of the same concepts, which hinders any meaningful comparison. Third, the causal mechanism underlying the analogical argument is only one among many possible explaining factors of ecosystems' stability. Fourth, Lietaer assumes that monetary and natural ecosystems are comparable, which may be open to doubts. Finally, there is no evidence that monetary plurality, as conceived by Lietaer, will give birth to a stable monetary system.

2.3. Normative Limitations

The analogical argument suffers from a second range of problems. Lietaer and his co-authors do not make sufficiently explicit the moral principles on which their proposal is relying. Nor do they confront their arguments to possible objections relating to what it would entail.

The first problem concerns the concept of resilience. As Brand and Jax (2007) show, it is possible to find several meanings for this term in Ecological economics. Moreover, depending on its definition and on its use, this concept can have both a descriptive and a normative interpretation (Brand and Jax, 2007; Strunz, 2012). Originally, the resilience of natural ecosystems was considered to be a purely descriptive concept (Holling, 1973) and many authors in Ecological economics still define it in a strictly descriptive way (Derissen et al., 2011). However, the concept has increasingly been interpreted in a more normative way, especially in socio-ecological studies (e.g. Walker et al., 2004). Lietaer's work is clearly part of this latter tendency (Lietaer repeatedly cites Walker et al. (2004) as a source of inspiration).

Recall that, for Lietaer et al. (2012, p. 78), resilience “measures the ability of a system to recover from a disturbance”. This definition has a clear descriptive content, which was the object of the previous sections. However, Lietaer's use of resilience, especially in the context of monetary systems, raises many normative questions. In that specific context at least, one may be right to wonder whether any sort of resilient response to a monetary or economic shock is desirable. First, the shock itself might be welcome. Just think about popular revolts against tyranny, or against plutocracy. Second, all resilient responses are not desirable. For instance, can a response that causes harm count as resilient? Strictly speaking, austerity measures constitute a resilient reply to financial meltdowns: it may help bringing the system back to equilibrium. Almost everyone would agree that a financial meltdown is a detrimental shock but generally disagrees about the most effective or just response to it. Third, a resilient response to a shock might drive the economy towards a new equilibrium, which may not be as desirable as the initial one. In the case of a financial crisis, the nature of the post-crisis equilibrium depends greatly on the government's response: whether it chooses austerity measures or a Keynesian economic boost will make a great difference. In short, we can say that the concept of resilience has an important normative side: we need to know to what shocks we ought to respond and what an adequate or just or efficient response would be. Unfortunately, Lietaer and his co-authors do not provide a clear answer to these questions.

The second issue concerns the nature of stability. Is stability inherently desirable? Lietaer's theory does not make sufficiently explicit what kinds of economic or monetary system one ought to keep stable. It points at the stability of a system, regardless of the desirability of that

system. In a way, the present monetary system is rather resistant to shocks: the dollar system is still in place in the US after several important financial crises, wars and policy changes. I doubt Lietaer would find this desirable. What he desires is a just and sustainable economic system, not a system that perpetuates injustice and environmental harm. Let's imagine that complementary currencies would contribute to maintain an unjust economic system, would this be a desirable outcome? We would need some normative criteria to determine what we ought to keep stable, and why we ought to keep it stable. Stability is one important value: relentless shocks, booms and recessions should be avoided, as far as possible. However, this is not enough. We need other values to evaluate our economic system. One would need to know, for instance, whether this system guarantees basic human rights, or whether it achieves some kind of distributive equality. Unfortunately, this discussion is absent from Lietaer's account, which largely ignores current debates on (normative) theories of sustainability and inter-generational justice.

3. The Growth Imperative

Douthwaite, as well as Lietaer and his co-authors, offer a second argument in defence of monetary plurality. In short, they claim that it could undermine the growth imperative that plagues our economies. This section first presents their argument in detail. Second, it examines whether our economies really suffer from a monetary growth imperative. Finally, assuming that it does, it studies whether Lietaer and Douthwaite's proposals would effectively counter that growth imperative.

3.1. Presentation of the Argument

Both Lietaer and Douthwaite argue that one of the root causes of the unsustainability of the present monetary system concerns the way money is presently created (Douthwaite, 2000; Lietaer et al., 2010). Nowadays, private banks create money each time they make loans, as new loans translate into new deposits (McLeay et al., 2014). This process has several checks. Prudential regulations usually restrict the kinds of loans that banks can make (Dietsch et al., 2018). Central banks can indirectly control the amount of money created by private banks through monetary policy, most notably by setting reserves requirements and the interest rate paid on these reserves (Goodhart et al., 2014). According to Lietaer and Douthwaite, these checks are insufficient and money creation by banks in the form of loans still creates a "growth imperative", which inherently plagues our current monetary system. Credit requires debtors to repay their debt with interest, and, therefore, it forces people to constantly increase production in order to repay a debt that is permanently growing (see also Farley et al., 2013; Kuzminski, 2013; Loehr, 2012). Because this growth imperative is in contradiction with the finite nature of the resources of our planet, the present monetary system is, according to these authors, unsustainable.

Lietaer and Douthwaite do not argue for the immediate ban of bank money. Rather, they contend that their project of implementing an Ecology of money could reach this goal gradually, by slowly reducing the need for bank money. That project would involve a myriad of parallel currencies, from local currencies and regional currencies to Local Exchange Trading Systems (LETS), barter systems such as the WIR, and large-scale government sponsored projects such as the NU in the Netherlands or the Torekes in Belgium. Despite their disparities, what these currencies have in common is that they do not require their users to indefinitely produce more, invest more and borrow more money (Lietaer et al., 2012, pp. 139–184). In short, they are not subject to a growth imperative. LETS and local currencies, for instance, rely on a charter that explicitly ban loans with interests (Blanc and Fare, 2016). Therefore, if an Ecology of money is implemented, more and more payments and investments would no longer depend on conventional bank money, and the imperative to grow would weaken.

In addition, Douthwaite also advocates the creation of a single "energy-backed" currency, whose creation would be limited according to the availability of CO₂ emission rights (Douthwaite, 2000, 2012). Similarly to a gold standard, the amount of money in circulation would be directly linked to the availability of a given resource (here "CO₂", not gold). Every other currency would be tied to that currency, thanks to appropriate exchange rate mechanisms. The existence of such a currency would, according to Douthwaite, restrict money creation and, mechanically, also limit economic growth. However, Douthwaite does not explain how the "energy-backed currency" proposal would allow to achieve sustainability and he offers no articulate theory in support of his claims. Why would growth be "mechanically" limited if money was tied to CO₂ emissions? After all, for more than a century, the gold standard allowed capitalism to flourish in a way that was very detrimental to nature (Polanyi, 2001, pp. 21–32). Why would an "energy-standard" limit growth, if the gold standard could not? A related, though different, objection to Douthwaite's claim concerns what some authors have called the "Chicago Plan". Several economists (most notably, I. Fisher (1935)) have proposed to limit money creation drastically (for a contemporary treatment, see Benes and Kumhof, 2012). Contrary to Douthwaite, however, they argue that it would lead to economic growth (not de-growth), while making the economic system less prone to crisis. Douthwaite, therefore, owes us an explanation of how his proposal, while restricting money creation, would also restrict growth. Unfortunately, so far, the explanation is lacking. For all these reasons, I will not study this latter proposal in detail here (for a deeper look, see Collins et al., 2013) and rather focus on what Douthwaite and Lietaer have in common.

3.2. Is there a Growth Imperative?

Several studies have recently examined the claim that a monetary growth imperative necessarily pushes our economies towards indefinite economic growth (Berg et al., 2015; Cahen-Fourot and Lavoie, 2016; Jackson and Victor, 2015; Richters and Siemoneit, 2017, 2019; Strunz et al., 2017). Richters and Siemoneit (2019) help clarify the debate by making a distinction between a mere driver of growth and a real growth imperative. They define the latter as "exterior conditions that make it necessary for an agent (such as an individual, firm, or state) to increase their economic efforts as to avoid existential consequences" (Richters and Siemoneit, 2019, p. 129). In the case of a monetary growth imperative, for instance, "exterior conditions" refer to the requirement to repay one's debts with interest and "existential consequences" relate to the fact that failing to repay one's debt would lead to bankruptcy for firms and severe economic loss for individuals. Are interest-bearing loans creating such an imperative to grow? Several authors have argued that the growth imperative argument was suffering from several important issues.

First, one should never forget that the power of banks to create money is restricted by competition and profitability, as well as by numerous regulations (Goodhart et al., 2014; Strunz et al., 2017). Banks cannot and have no interest in creating large amounts of debts indefinitely, as competition will tend to push down interest rates on new loans, hence affecting their profitability. Therefore, even if regulations and competitive pressure do not rule out the possibility of a growth imperative, they nevertheless put some limits to money creation.

Second, as Richters and Siemoneit (2017) have shown, the proponents of the monetary growth imperative model neglect that creditors could consume or invest their interest income, so that money flows back into the economy and no growth imperative is induced. Only if creditors wish to hoard their monetary holdings indefinitely can a growth imperative occur. So, as Richters and Siemoneit (2017) argue, growth is not "structurally inevitable" but primarily a product of the choices of many individuals. This point may be put in simple terms, as follows. When explaining the growth imperative, Lietaer generally takes the following example (Lietaer et al., 2012, chap. 5): a foreigner proposes

to lend money to villagers, but asks them to repay it with interest at the end of the year. Accepting that offer allows villagers to produce more, but also generates an obligation to grow, in order to repay the debt. Let me now modify slightly Lietaer's example and assume that the money lender is not a foreigner but a member of the community. If that person consumed all his revenue, for instance by buying the villagers' goods, money would flow back to them, so that they could repay their loans without being required to produce more.

Third, and most importantly, several Post-Keynesian authors have argued for the possibility of a stationary state with a positive interest rate (Berg et al., 2015; Cahen-Fourot and Lavoie, 2016; Jackson and Victor, 2015). For Post-Keynesians, money creation is an endogenous process. As Cahen-Fourot and Lavoie (2016, pp. 164–165) put it: “Money is created through bank credit when economic agents have a credit-worthy demand for it.” In other words, this means that “the rise in production takes shape in the mind of producers before money is created and is effectively realized when credit is granted and money is created to finance it.” The growth in production drives the growth of the money supply. For Post-Keynesians, the money supply can in no way be held responsible for the growth of output, which entails that there cannot be a money-led growth imperative.

3.3. Can an Ecology of Money Get Rid of the Growth Imperative?

These three problems raise doubts about the claim that there is a monetary growth imperative. Note, however, that the two first problems do not completely rule out the growth imperative, and that Post-Keynesian theory is not uncontroversial. Clearly, Lietaer and Douthwaite, as well as many orthodox economists, have contrasting views on the matter. Disentangling the debates between these different schools of thought is well beyond the reach of this article, though. Let us assume, then, for the sake of the argument, that a growth imperative does pose a threat to the sustainability of the monetary and ecological systems. Could a monetary system made of a plurality of currencies get rid of the growth imperative?

According to Lietaer and Douthwaite, the key mechanism behind the monetary growth imperative is the current money creation process. As we have seen, they argue that money creation by banks in the form of loans triggers a growth imperative. Neither authors argue for the immediate ban of bank money, though. Rather, they argue that the growth imperative can be tamed if people, corporations and states start to use complementary currencies on a large scale. In effect, they call for the slow replacement of bank money by interest-free complementary currencies, immune of any growth imperative. Consequently, the central challenge for them is to make sure that people will effectively adopt such currencies and accept to use them.

Up to now, complementary currencies have had a relatively low success in attracting users, despite the fact that there are very few legal barriers to their implementations and wider use (Attout et al., 2013). Moreover, the financial crisis could have opened a new era for these currencies, as mainstream banks and financial markets were contested and blamed for their reckless behaviour (Turner, 2016). However, no significant surge in adoption was acknowledged at the time (Blanc, 2018). One explanation might be that the power of routine is very strong, so that people keep using a currency simply because they are used to using it (Aglietta and Orléan, 2002). Money has a special feature: it only makes sense to use it if it is accepted by a sufficiently large number of people (Tobin, 2008). This entails that currencies that are already circulating on a large scale benefit from network effects while smaller currencies may struggle to grow. The power of habit and the inconvenience of change may discourage people to turn to a new currency. Alternatively, we could think that these currencies do not provide enough incentives for their adoption. Their advantages are mainly potential, and there are no signs of any real significant impacts of these currencies on the environment or the economy (Dittmer, 2013; Marshall and O'Neill, 2018; Michel and Hudon, 2015). On the contrary,

bank money has a huge advantage, at least for a significant portion of economic agents: it gives creditors the power to earn money simply by lending it. Why would they wish to relinquish that privilege? Debtors might consider that complementary currencies could be at their advantage, though. However, no surge in adoption that could reflect that reasoning has yet been acknowledged. A possible explanation of that fact is that participating in such schemes can entail a certain number of costs that might discourage many potential users. First, the cost of dedicating time and commitment as a participant in these schemes should not be underestimated (Aldridge and Patterson, 2002), and is among the main reasons for the failure of several complementary currencies to attract a large audience (Blanc, 2018). One should also mention the transaction costs of dealing with multiple different currencies at the same time, which possibly means multiple bank accounts, means of payments, and accounting mechanisms.

The problem is that the Ecology of money proposal cannot fulfil its objectives if it is not widely accepted and implemented. Indeed, for a currency to have any effect on the economy, a sufficiently large number of people and institutions (banks, states) should use it. Currently, however, neither the economic context nor the potential benefits of Lietaer's proposal seem sufficient to trigger the spontaneous and free adoption of Lietaer's proposal by a large variety of individuals and firms. Lietaer and his co-authors (2009) argue that states could accept alternative currencies in partial payment of taxes, so as to incentivize people to use them. However, that horizon is, for now, out of sight.

4. Conclusion

Douthwaite and Lietaer argue that a monetary system constituted of a large array of alternative complementary currencies would be more resilient and less prone to crisis than the present monetary system. They also argue that it could help defeat the growth imperative that, according to them, plagues our economies.

Regarding the first argument, I showed that neither Lietaer nor Douthwaite are able to provide clear and precise definitions of resilience, efficiency and stability. Moreover, their definitions often differ from mainstream notions in ecology. I also argued that the analogy between natural and monetary ecosystems was unlikely to hold. First, there is presently no empirical evidence supporting that analogy. Second, the concepts and causal mechanisms at the heart of the diversity-stability relationship in scientific ecology differ starkly from those of Lietaer's theory. Third, Lietaer assumes that monetary and natural ecosystems are comparable, which may be open to doubts. Fourth, the Ecology of money tends to rely on overconfidence in the spontaneous capacity of a plural and diverse monetary system to reach a stable equilibrium without any significant interventions by the state. I have argued, however, that there is no evidence that monetary plurality, as conceived by Lietaer, will give birth to a stable monetary system. Finally, the analogical argument fails to provide sufficient normative reasons to favour an Ecology of money.

Regarding the second argument, several theorists have raised serious doubts regarding the existence of a monetary growth imperative. However, even if we assume that there is such an imperative, the relatively low success of complementary currencies in attracting new members entails that the Ecology of money proposal is very unlikely to effectively curb growth. People seem reluctant to use multiple currencies in parallel to each other, for various possible reasons. Therefore, we can doubt that monetary plurality will be implemented in the near future, and that it will be able to challenge any credit-driven growth imperative, or to foster the stability and resilience of our monetary system.

The doubts raised about Lietaer's and Douthwaite's proposals do not entail that we should give up the struggle for a just financial system, nor that monetary plurality is necessarily ruled out as a desirable alternative to our monetary system. This article is not a defence of the status quo. Our present monetary system is far from perfect, as the recent

financial and sovereign debt crises have shown (Turner, 2016). Further research is needed, however, to inquire how complementary currencies or other monetary reforms could contribute to making our financial system more just, less unstable and more harmoniously imbedded into our social and natural environment.

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