10. MONEY AS THE POTENTIAL CAUSE OF *THE TRAGEDY OF THE COMMONS*

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Abstract

This paper draws attention to the potential cause of "the tragedy of the commons", which locks people into economic systems that compel the pursuit of self-interest and eventually bring ruin to all. The potential cause consists in numerous issues of money and money equivalents that defy the first and the second law of thermodynamics under the legal arrangement. Money has a dual nature: a form of wealth from an individual person's perspective and a debt from a communal perspective. Money's dual nature perfectly corresponds to the phenomena associated with the tragedy of commons that are caused by the inherent conflict between the individual's concern with self-interest in economic welfare and the community's concern with long term sustainability.

Keywords: money, interest, disgregation, structural decay, functional decay, mutuum, cash credit
JEL Classification: G00, G21, H80

1. Introduction: Reconsidering *The Tragedy of the Commons*

Half a century ago, Garrett Hardin published a cerebrated article, *The Tragedy of the Commons* (Hardin, 1968). Hardin argued that the problem of population in a finite world is insoluble since technical solution demands changes only in natural scientific techniques without requiring changes in human values or morality. Hardin presented two typical examples with no technical solution, an open pasture management and pollution problem. These two are exemplars of decision-making problems motivated by the principle of "invisible hand" that often contradicts a society's aim for long term survival. Hardin proposes legislation of temperance based on socially acceptable coercion and, wittingly or unwittingly, he touches the essence of the *tragedy of the commons* through references to *gain*, *benefit* and *cost*, common pecuniary considerations of ordinary people in everyday life. For Hardin, "each herdsman seeks to maximize his *gain*"; "the individual *benefits* from his ability to deny

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the truth even though society as a whole suffers"; and the rational person has a "share of the *cost* of the wastes he discharges into the commons."

This paper draws attention to the potential cause of *the tragedy of the commons*, which locks people into economic systems that compel the pursuit of self-interest and inevitably bring ruin to all belonging to the systems. The aim is to encourage consideration of something not sufficiently recognized by many people who wish for a sustainable and more equitable society. We argue that the potential cause of phenomena leading to the tragedy of the commons consists in the human's ingenious creation of money that defies the first and the second law of thermodynamics. The first law of thermodynamics dictates that energy cannot be created. On the contrary, money is often created out of nothing and is extinguished into nothing during the recession under the present economic systems, not only by the banking systems, but also by the individual groups of people as well as by the nation states in the form of national bonds. This way of money creation mechanism dates back to the idea of *mutuum* in the Roman law. The second law of thermodynamics dictates that energy must decay or dissipate. On the contrary, money is authorized, under the legal and institutional arrangement, to be able to avoid the functional decay while it suffers the structural decay due to the entropy law, so that a positive money interest rate naturally emerges. Any individual person wants to obtain more money interest payments (or a positive return on an asset) and to create more money (or money equivalents); if possible, that guarantees a positive interest return. Money is regarded as wealth for an individual person. Therefore, the total amount of money inevitably tends to increase through the invisible hand. In fact this is what we are witnessing in the present world. However, money is a debt to the whole community, since money entails a promise to pay in the future and ultimately dictates the community as a whole to give commodities or services to the owner of money on demand. So, money has a *dual nature*: money can be seen *as a form of wealth from an individual person's perspective*, but can be seen *as a debt from a communal perspective* (Mayumi, 2018). Thus the dual nature of money perfectly corresponds to the phenomena associated with the tragedy of commons that are caused by the inherent conflict between the individual's concern with self-interest in economic welfare and the community's concern with long term sustainability..

2. Money Creation and the First Law of Thermodynamics

The first law of thermodynamics dictates that energy cannot be created or destroyed in an isolated system. In the financial world, however, money in the form of credit can be created in the banking system out of nothing and disappear into nothing by human will (Macleod, 1889). In one of the most innovative discoveries in human history, bank ledgers or accounting books can create or destroy money. Thanks to banking systems, a person can have a certain amount of money and another person can have the same amount of money, a form of magic that Ruskin strongly opposed in his 1862 work *Unto This Last*: "[C]are in nowise to make more of money, but care to make much of it; remembering always the great, palpable, inevitable fact---the rule and root of all economy---that what one person has, another cannot have" (Ruskin, 1985). Schumpeter describes this credit creation: while "I cannot ride on a claim to a horse, I can, under certain conditions, do exactly the same with claims to money as with money itself" (Schumpeter, 1951).

Why money creation through the banking system is legally and institutionally possible?

The long journey that has led to the authorized credit creation system is at least as old as the Roman mercantilism, with its *commodatum* and *mutuum* lending (Macleod, 1883). In *commodatum* lending of *durable* commodities, a borrower could enjoy use of a book without acquiring absolute property ownership of that book and in *mutuum* lending of *consumable* commodities, a borrower of bread could not enjoy its use without destroying what was loaned. Under Roman law, if a person loaned money to another person, that money became the other person's property, meaning that money was treated as if it could be consumed in the manner of *mutuum*. Thanks to such treatment, bank deposits could be considered absolute property of the banker because when a banker recorded money as a deposit in a book account, the lender ceded property to the borrower. In this way, new property was created via the new contract between the lender and the borrower. So, credit creation mechanism started as if bank deposit were the property of bankers.

Modern economic systems feature various ways of "minting" money or money equivalents called financial assets, such as credit cards, financial commodities, national and local bonds, cooperate bonds, gift certificates, etc.

3. Money Interest and the Second Law of Thermodynamics: Functional Decay and Structural Decay

The second law of thermodynamics (entropy law) scientifically interprets the universal tendency of heat to disperse from high localization and spread unless heat is constrained. It is now common knowledge that, like heat, all material objects tend to decay or disperse. In 1862, as Clausius considered material dispersion in relation to the entropy law, he identified a variable called *disgregation* that quantifies molecular dispersion in a thermodynamic system (Clausius, 1862). In so doing, Clausius may have suspected that change in disgregation corresponds to change in position of molecules in a system and that disgregation is more fundamental than entropy because disgregation can be used to interpret entropy's true nature (Klein, 1961). Furthermore, as Gibbs correctly indicated in 1889 in his obituary dedicated to Clausius, the disgregation does not depend on the velocities of particles within the system (Gibbs, 1994). Therefore, the disgregation differs from the entropy concept that is generally believed to refer only to the dissipation of energy based on the distribution of the particle velocities.

Entropy S can be related to thermal content of a system and disgregation by equating entropy with heat dispersion (d'H/T) plus material dispersion (d'Z):

$$\mathrm{d}S = \mathrm{d}'H/T + d'Z \tag{1}$$

where: T is the absolute temperature, H is the thermal content of the system and Z is disgregation. It must be emphasized that since entropy S is a state function, dS is a total differential, while neither d'H/T nor d'Z is a total differential. Relation (1) confirms that the concept of entropy can be safely applied not only to energy, but also to matter! In fact, in the case of the diffusion of two perfect gases, the diffusion phenomenon must be interpreted as dissipation of matter. Planck reinforces this interpretation (italics added): the case of diffusion of two perfect gases "would be more to the point to *speak of a dissipation of matter than of a dissipation of energy*" (Planck, 1945, p.104). Thus, the dissipation matter, namely, disgregation, is of vital importance for interpreting the meaning of entropy.

Applying the entropy concept to both energy and matter, Georgescu-Roegen tried to formulate dissipation of mineral resources in economic processes (Georgescu-Roegen 1977). His investigation suggests that (i) flows of dissipated matter in bulk increase with the scale of economic production and consumption activities and (ii) it is difficult to maintain large-scale infrastructure in modern industrial society.

However, perhaps the readers will be astonished if we tell that the diffusion of material structure based on disgregation could be used to explain the clue to the origin of money interest. Every material object has material structure, *i.e.*, *structural component,* and particular purpose for use, *i.e.*, *functional component*. As a structural element decays due to entropy law, its functional element jointly decays and the material object may no longer be used for the particular purpose for which it was originally intended (Mayumi, 2018).

Hard currencies such as coins and bank notes cannot avoid the entropy law insofar as their structural decays. Nevertheless, the functional element of money does not decay along with its material decay because the *functional component* of money is legally and institutionally guaranteed. To use examples from Japan and the USA, the functional element of Bank of Japan notes is legally guaranteed: "The Bank of Japan shall exchange, without fees, Bank of Japan notes rendered unfit for further circulation due to defacement, mutilation, or other causes, pursuant to an Ordinance of the Ministry of Finance" (Bank of Japan Act, 2017). US law stipulates: "Lawfully held mutilated paper currency of the United States may be submitted for examination in accord with the provisions in this subpart. Such a currency may be redeemed at face value if sufficient remnants of any relevant security feature and clearly more than one-half of the original note remains" (The Code of Federal Regulations, 2017).

Money interest stems from the legal and institutional arrangements that allow money to be used to postpone the timing of transactions and to make money superior to other commodities involved in economic exchange. Other types of interest associated with capital and financial assets can be deduced as a corollary from the emergence of money interest. Because of positive interest rates for various forms of money and money equivalents because individuals regard money as wealth, the total amount of money and money equivalents tend to increase and individuals with such money or monetary equivalents try to obtain more.

4. Money and Its Implications: The Potential Cause of the *Tragedy of the Commons*

Money and money equivalents entail the right to demand equivalent commodities and services in the future. That is to say, money and money equivalents represent debts due to people who have performed services for other people without yet receiving equivalent services in return. In such a way, money can be seen as a form of wealth from an individual perspective and as a debt from a communal perspective, with the owner of money being the creditor *individually* and the issuer of money being the debtor *communally* as *a whole*. In current socioeconomic systems, the issuer of money is supposed to be a nation state but money equivalents may be created by banking systems or other groups within the society. Consequently, it may be overlooked that legal and institutional setting permits money to a debt to a nation state that can accumulate progressively with a positive interest rate. Such a situation makes it important for democratically elected representatives of a nation state to have full control of the total quantity and distribution of money (general liquidity) to be issued. Clearly, there is reason to oppose the private issue of money ardently proposed by Hayek that is already occurring on an incredibly large scale (Hayek, 1990).

Up to this point our discussion follows as if money were used only within a particular community or a country. In fact, the description of the dual nature of money above ignores a truly formidable problem associated with money and money equivalents on the world level consisting of a variety of nation states that are "hierarchically organized". Before the Bretton Woods system of monetary management finally collapsed in 1971, the USA issued a large quantity of money for financing the Vietnam War and propagated the worldwide inflationary phenomena. Nowadays, several major economically influential units such as the USA and EU, for example, can issue money and money equivalents almost independently at will. Those money equivalents can be exchanged in the world market and thus influence the commodity price levels, the asset prices and the interest levels (or asset returns) in any other country. Furthermore, the discount rate determined by The Federal Open Market Committee, for example, could create a variety of repercussions mainly through the effective exchange rates fluctuations of the major currencies. On the other hand, economically smaller countries are forced to accept these influences without having any preventing tools against these merciless forces. Unfortunately, we do not have strong and useful tools to deal with those problems under the current international setting.

5. Conclusion

Money and money equivalents demand consumable goods and services in the future as a promise to pay. For a community, this promise to pay expands disproportionately as long as positive interest or other financial returns are guaranteed. Decades ago, this collective system of economic debt became recognized as *running solvency* (Mark, 1934). Since money and money equivalents are regarded as wealth from an individual's perspectives, any person driven by the invisible hand tends to strive to obtain more money equivalents, resulting in further expansion of money and money equivalents without necessarily accompanying the accumulation of real capital.

On the other hand, there is a very interesting historical event concerning a proper use of money system that happened in Scotland in the 18th century. This credit system was called Cash Credit (Macleod, 1883) that is an accommodation paper in current financial usage. Accommodation paper is a negotiable instrument that provides a third-party promise of payment if the original borrower defaults. Accommodation papers are usually used to support one party's creditworthiness through endorsement by a second party with a better credit rating. These cash credits were extended in the domain of agriculture and public works as well. The principle of the limits of credit is the present value of the estimated future product. Thus in these cases credit was used to produce real capital exactly in the same way that money is originally intended. All these marvelous results, which raised Scotland from the lowest depths of barbarism up to her proud position in the space of 170 years or so are the children of cash credit based on mutual trust among concerned people.

Unfortunately, at the moment an unlimited growth of the debt is exploiting the most important "common resource" – *i.e.* social trust and fabric. The tremendous growth of debt provides benefits to a fraction of the world population only for a temporary period but it entails the erosion of the existing social trust and the destabilization of the social fabric in case of debt default. As far as money and money equivalents are concerned, the solution suggested by Hardin to deal with the tragedy of the commons is still valid. Ideally, as Frederic Soddy (2003) and Silvio Gesell (2013) proposed long ago, it can be possible to legislate a certain temperance based on mutual international coercion in order to keep just enough money and money equivalents to make exchanges of goods and services required for maintaining a

decent life without leading to the Ponzi fraudulent investment scheme abusing the mutual trust among concerned people, that is the ultimate form of *the worldwide tragedy of the commons*.

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