2019

A Socio-Ecological Revolution in Monetary Theory: An Argument for, the Development of, and an Application of Ecological Monetary Theory

Joe Allen Ament
University of Vermont

A SOCIO-ECOLOGICAL REVOLUTION IN MONETARY THEORY: AN ARGUMENT FOR, THE DEVELOPMENT OF, AND AN APPLICATION OF ECOLOGICAL MONETARY THEORY

A Dissertation Presented

By

Joseph A. Ament

to

The Faculty of the Graduate College

of

The University of Vermont

In Partial Fulfillment of the Requirements
For the Degree of Doctor of Philosophy
Specializing in Natural Resources

October, 2019

Defense Date: August 26, 2019
Dissertation Examination Committee:

Joshua Farley, Ph.D., Advisor
Pablo Bose, Ph.D., Chairperson
Jon Erickson, Ph.D.
Brendan Fisher, Ph.D.
Cynthia J. Forehand, PhD., Dean of the Graduate College

Abstract:

Money is the most ubiquitous institution on the planet. It gave rise to literacy, mathematics, sedentary community, and the concept of universal value. Against this backdrop, however, hardly anyone understands what money is. Orthodox monetary theory conceives of money as a neutral commodity that facilitates barter. Presupposing this theory is a dualistic and atomistic ontology in which reality is organized into hierarchically ordered opposites of superiority and inferiority and complex interactions are reduced to summations of their attendant parts. Accordingly, monetary policy is enacted as though money were any other commodity, subject to the barter dynamics of supply and demand. In this manner, the vast majority of money in modern economies is created by commercial banks in pursuit of profit maximization.

An interdisciplinary literature conceives of money as a social relation of credits and debts denominated in a unit of account. Such an approach complicates and undermines the assumptions of economic theory and allows for a more effective approach to the problems attendant to modern money. This dissertation draws upon this literature to develop an Ecological Monetary Theory (EMT) that is simultaneously rooted in a social understanding of money, and an ontology of embeddedness.

The first chapter draws upon ecofeminist theory to explore the ontological presuppositions of neoclassical economic theory and the monetary theory it informs. It argues that the dualism and atomism central to Western philosophy manifest as the misleading conceptualization that money is a commodity that facilitates barter. It then explores an interdisciplinary literature to argue that barter has never existed as an economic mode and money's nature lies rather in the unit of account. It then argues that ecological economics must develop a theory of money of its own in order to avoid importing the dualistic ontology at the heart of orthodox monetary theory.

The second chapter develops an ecological monetary theory. It does this by using an interdisciplinary literature to answer three closely-related questions: What is money? How does money get its value? How does money get into society? It then develops an ontology of embededdness by exploring the ontological presuppositions of ecological economics and ecofeminism. Then it develops a two-tiered theory in which money's abstract social nature is mediated against its tangible biophysical claim through this ontology of embeddedness in order to address the contradiction at the heart of both social and material conceptions of money.

The third chapter uses ecological monetary theory to test the desirability of a public banking proposal. In such a proposal, the prerogative of money creation is taken from the commercial banking sector and given solely to the State. This returns seigniorage to the public and allows the government to create money for social and ecological purpose, destroying money through taxation in order to maintain the money's value. This chapter determines that, given certain parameters, public banking is a desirable alternative to the current monetary system.

Citations

Material from this dissertation has been published in the following form:

Ament, J., 2019. Toward an Ecological Monetary Theory. Sustainability. 11, 923. https://doi.org/10.3390/su11030923

AND

Ament, J., 2019. An Ecological Monetary Theory. Ecological Economics. 166

Dedications

For my best friend, Caitlin, who endured years of sleepless nights and far-off days as I dreamed up and wrote this dissertation.

For my family—for everything.

Acknowledgements

I would like to thank my committee—Joshua Farley, Jon Erickson, Brendan Fisher, and Pablo Bose—for four wonderful years of engaging conversation, helpful comments, and positive attitudes. The last four years have been my pleasure.

To Peter Brown for creating a new generation of ecological economists. The passion to envision and the wherewithal to carry out such an ambitious project is inspiring.

Thank you Ben Dube and Janica Anderzen for their friendship on this journey.

Thank you to Romain Svartzman for so many long conversations about money. It has meant the world to share this time with him.

Thank you to David Barmes and Charles Guay-Boutet for teaching me so much.

To Hilary Byerly and Aaron Schwartz for years of laughs.

To the Gund Institute staff: Taylor Ricketts, Nora Shahoud, Basil Waugh, and Jeannine Valcour. Thank you for creating an amazing space to call work.

To all the Gund and Rubenstein students. I am proud to have learned from and journeyed with you all. From moose-trackers to economists, I am always in awe of your work.

To Alex and Gordon for helping me start each day with a big smile and a hot cup.

To the New Economics Foundation, Positive Money, and Copenhagen Business School group: Ole Bjerg, Josh Ryan-Collins, Ben Dyson, Joseph Huber, Laurie Macfarlane.

To Gar Alperovitz whose body of work helped me frame the disparate threads within.

I would like to thank Geoffrey Ingham for writing *The Nature of Money*. I could have never written this dissertation without it.

A very special thanks to Mary Mellor. With an impressive and humbling body of literature spanning ecofeminist political ecology to monetary theory, her words are never more than a few inches from my keyboard.

Table Of Contents

Introduction

1. Background, Literature Review, and Problem Statement

1.1 Contradictory Theories of Money

Money is more ubiquitous than any institution on the planet (Haselgrove and Krmnicek 2012, 235). Research suggests that money shaped our cognitive processes (Lea and Webley 2006) and gave rise to literacy, mathematics, sedentary community, and the concept of universal value (Martin 2015), while eroding the bonds of social trust upon which civilization rests (Mellor 2015; Théret 1999; Henry 2004). Politicians debate about it, investors speculate upon it, and citizens dedicate themselves to earning it, yet hardly anyone understands what money is. Those who think they do, Daly notes, have probably not thought about it enough (Farley and Daly 2011).

Neoclassical economic theory conceives of money as a neutral commodity medium of exchange that arose to facilitate otherwise inconvenient barter exchanges (Samuelson 1948). Since barter transactions engender the double coincidence of wants problem wherein each economic agent must simultaneously want what the other has and have what the other wants (Smith 1976, 21), a commodity money emerges to provide a unit of account and allow agents to store the value of their goods (Walras 1954, 188). Therefore, while orthodoxy contends that money embodies three functions—medium of exchange, unit of account, and store of value—the medium of exchange is nevertheless the key function that allows the others to address the barter problem (Ingham 2004, 6). Conceiving of money this way is rooted in a functional approach to thinking about what money *does* and specifically how it helps alleviate the inconveniences of barter. In this

conception, value is the foundation of money and money simply provides a tool with which agents may exchange that value.

Underlying neoclassical economic theory, and importantly the conceptualization of money that it informs, is a dualistic philosophical framework in which reality is divided into hierarchically ordered opposites of superiority and inferiority (Ament 2019b). Dualism manifests itself in economic theory as a denial, objectification, and inferiorization of the labor and natural resource inputs inherent in barter exchanges. Atomism emerges from dualism by reducing the complexity of barter exchanges to a summation of its attendant parts. In these barter exchanges, money is simply the commodity that atomistically facilitates equilibrium based upon the value commensurability in the exchange.

An interdisciplinary literature that includes philosophy (Simmel 2004), sociology (Dodd 1994; Ingham 2004), history (Grierson 1977; Gardiner 2004; Innes 1913; Knapp 1924), archaeology (Hudson 2004), and anthropology (Graeber 2014; Muzio and Robbins 2017) conceives of money as a unit of account for denominating credits that are capable of settling debts. In this view, money's nature—what it *is*—takes precedence over money's functions—what is *does*. Innes went so far as to argue that "there is no such thing as a medium of exchange" (1914, 168), an exaggeration meaning that particular media are simply token representations of the unit of account that embodies money.

This conception of money is rooted in the fact that, historically, there is no evidence that barter has ever existed as an economic system (Humphrey 1985). Since most products involved in exchange are seasonal by nature and involve sequential production stages, direct barter exchange is often impossible (Gardiner 2004, 130).

Similarly, there is the logical problem of a barter actor specializing in production before he/she has the finished goods with which to barter for raw materials. Conceiving of money as a system of credit and debt, denominated in an abstract unit of account is, thus, historically- and logically-accurate and allows us to consider money as a social relationship rather than a calculated exchange (Wray 2004).

Contrary to the neoclassical view, in this conceptualization, money is the foundation of value. Particularly, the particular manner in which credits and debts are created and destroyed and the constitution of the entity that determines the unit of account lays the foundation for what has value in an economy (Ament 2019a; Svartzman, Dron, and Espagne 2019).

1.2 How Modern Money is Created

Approximately 98% of the modern money supply is created by commercial banks when they issue loans to individuals and corporations at interest (A. Jackson and Dyson 2012; Ryan-Collins et al. 2012; Farley et al. 2013). While it is widely assumed that banks use existing customer deposits when extending loans, when a bank generates a loan, it increases the borrower's deposit account *ex nihilo* by entering a number equal to the amount of the loan into a computer, regardless of the prior existence of deposits (Wray 2015).

When customers wish to spend this credit money, they may do so in one of three ways. If the transaction involves two customers of the same bank, the bank simply transfers the deposit balance from the purchasing customer to the selling customer. If the transaction involves customers of different banks, the purchaser's bank will transfer

reserves from its account at the central bank to the reserve account of the seller. If the customer would like to make a purchase without a bank intermediary, he/she may withdraw cash (Ament 2019a).

The nation's entire money supply is, thus, made up of commercial bank credit and central bank money consisting of cash and reserves. Reserves can only be attained by commercial banks and are held at the central bank for use in interbank customer transactions. Since billions of transactions occur daily, each night, reserve positions between banks are netted. If a bank owes reserves it may borrow them from other banks on the inter-bank lending market or from the central bank. Banks attain cash for customers in exchange for reserves. Accordingly, cash and reserves are physical and ledger manifestations, respectively, of interest-bearing commercial bank money. Therefore, while 98% of the money supply is *created* by commercial banks, the entire money supply is a *function* of commercial bank lending.

Mainstream economic theory conceives of bank-created credit money simply as an evolution of commodity money that arose to overcome the transactions costs of using gold (Mankiw 2013, 84). It conceives of fractional reserve banking through a system in which the central bank creates a sum of base money that savers deposit within the commercial banking industry. While banks are required to hold a fraction of deposits in their vault, the majority can be lent, re-deposited, and re-lent in a cycle that yields a total money supply that is a multiple—the inverse of the reserve requirement, usually ten times—of initial central bank base money.

This conception of bank-created money is an extension of the dualism and atomism at the center of the neoclassical model (Ament 2019b). While bank money is not

a commodity per se, it is nevertheless conceived of as a finite resource that is controlled by the central bank and allocated between borrowers and savers by way of barter-based supply and demand dynamics (Ingham 2004, 7).

While orthodoxy conceives of reserves as deposits that banks hold in the vault in order to satisfy customer demands (Mankiw 2008, 333), reserves are in fact generated in response to lending in order to satisfy interbank transactions. Accordingly, while orthodoxy conceives of bank money as a multiple of initial central bank money, implying that control lies with the central bank, central bank money is always created in response to, and as a fraction of, bank lending and full control of the money supply lies with the commercial banking sector (A. Jackson and Dyson 2012). This is the moral hazard at the heart of central banking (Daly 1994; Røpke 2015) whereby maintaining economic stability by reactively upholding the system of interbank payments leads to exuberant instability as banks lend whatever they deem profitable (Minsky 1986).

1.3 Problems Attendant to Private-Debt Money

The modern money system plays a central role in creating, exacerbating, and blocking solutions to many of the problems we face today. Since the vast majority of money in circulation must generate profits enough to cover principal and interest, socially- and ecologically-harmful, profit-earning activities are prioritized over sustainable public goods and services that—far from returning profit—simply cost money. This means that education, sustainable agriculture, renewable forms of energy, and affordable housing must be either commodified or paid for with public debt.

From a social perspective, credit-based money systematically transfers wealth from borrowers and renters to lenders and landlords (Michel and Hudon 2015, 161). This is especially true when investment returns outpace economic growth (Piketty 2014). As Mann explains, money is a powerful tool for humanity, but its dual nature is problematic: beyond money's *infrastructural* power that has facilitated cooperation at large scales, money also embodies *despotic* power that can be appropriated if particular interests control its production (1986).

Ecologically, since debt-based money must always grow (Svartzman and Ament 2019), heavy strain is put on ecosystems to continually produce goods lest the economy crash. As Daly writes, "exploitation of *nonrenewable* resources at very rapid rates offers higher rates of return on investment and drives up the interest rate, putting more pressure on slow-growing species" (Daly 1994). This problem is not unique to goods since all goods *and* services have a physical dimension. "Even a 'service' is always a service of something or somebody for some period of time" (Daly 1994).

The modern profit-driven money system also embodies a contradiction in form that pits money against both social and ecological systems. Since money is not destroyed when it is used, it is able circulate in a manner that denies the second law of thermodynamics. Because of this, Gesell argued for a demurrage-based money that decays over time (1929). Similarly, Soddy argued that "you cannot permanently pit an absurd human convention, such as the spontaneous increment of debt (compound interest), against the natural law of the spontaneous decrement of wealth (entropy)" (2012). The central contradiction is that real wealth cannot grow exponentially, but our symbol and measure of wealth *must* grow exponentially. "This lack of symmetry," Daly

wrote, “between the reality measured and the measuring rod has serious consequences” (1994).

1.4 Ecological Economics’ Monetary Blindspot: A Problem and Opportunity

In neoclassical economic theory, money is not important; what is important are the barter equilibrium models that explain how exchanging value gives rise to social optimality. These models are ultimately rooted in a dualistic and atomistic ontology in which reliance upon inputs and the social relations inherent in trade are denied. Accordingly, not only does money not have importance, it cannot have importance. For if barter exchange is replaced by systems of credit and debt and if the commodity is replaced by an abstract unit of account, the Walrasian model that is central to the entirety of micro- and macroeconomics fails to reach equilibrium (Hayek 1935, 130; Ament 2019b).

The neoclassical reliance on the barter-commodity myth seeks to maintain equilibrium theory while simultaneously obscuring its view of both historical and modern monetary reality. Because of this, economic, ecological, and social problems attendant to the modern money system are seen as temporary functions of money’s quantity (Mankiw 2008) or its inefficient allocation (Krugman 2012) and not the structural manner in which it is produced or the socio-ecological relation it embodies. Policy solutions are, thus aimed at the effects, rather than the causes of the problems and rooted in a commodity theory that aims to realign barter equilibrium (Hayek 1935, 130; Lutz 1969, 115).

Ecological Economics broadly recognizes the importance of studying money and is concerned with the impacts of the modern money system (Farley and Daly 2011). Frederick Soddy, one of the field’s intellectual progenitors, was primarily concerned with

the entropic contradiction between physical wealth and the exponentially-growing measure of that wealth (Soddy 1930). Herman Daly has written frequently on the problems of the modern money system, arguing that without fundamental changes in our approach to money, the proposals of ecological economics "may prove insufficient" (Daly 1994, 407). Importantly, Farley et al. (2013), Dittmer (2015), Campiglio (2016), Jackson and Victor (2015), Brown et al. (2009), and Svartzman et al. (2019) have all considered the modern money system from varied perspectives.

Nevertheless, before this dissertation, the field has not offered a comprehensive and broadly accepted theory of money. In fact, neither A.M. Innes nor Friedrich Knapp are ever mentioned in the journal's history. Ingham is mentioned once as an aside (Dittmer 2015), and Simmel and Aglietta are mentioned, not in the context of money but of social order and capitalism. Together, these authors form a critical literature for understanding the nature of money. This lack of exploration of monetary theory has caused internal disagreement on such critical topics as interest (T. Jackson and Victor 2015; Cahen-Fourot and Lavoie 2016; Svartzman and Ament 2019), full-reserve banking (Fontana and Sawyer 2016; Dittmer 2015; Ament 2019b), and the ontology of value (Spash 2012; Brennan 1997).

Perhaps more importantly, however, without a theory of its own, the field has largely imported a barter-commodity conceptualization of money and, accordingly, the dualistic and atomistic ontological presuppositions of such a conceptualization (Mellor 1997). Daly writes that "barter…is the simplest and oldest method of exchange" and that "money…[is]…the standardization of one commodity as an instrument of exchange" (1994, 409, 414). Roma argues that "commodity money has been the economic standard

for thousands of years" (2006, 544). And Lawn writes that money "allows you to overcome the inconvenience…of bartering" (2010, 932). In fact, to my knowledge, only one paper in the field—the first chapter of this dissertation (Ament 2019b)—and one paper in the journal—the second chapter of this dissertation (Ament 2019a)—explicitly reject the barter myth of money's origins.

Therefore, while ecological economics sees the structural nature of modern money in a way that the neoclassical school does not, it nevertheless draws upon orthodox conceptualizations of money in its monetary critique (Lawn 2010) and policy proposals (Daly 2013). This gap represents a major opportunity for ecological economics to expand its theoretical offering by developing a monetary theory that is capable of addressing the problems of the modern system of money creation.

2. Dissertation

The goal of this dissertation is to develop a comprehensive and broadly accepted theory of money for ecological economics. Due to the dualism at the center of the orthodox model, this dissertation argues that an Ecological Monetary Theory must be rooted in a non-dualistic philosophical structure that values labor and resource inputs and understands the social and ecological dynamics inherent in money's production and use.

Such an ontological framework would place the human experience within an institutionalized and socially constructed context that exists in delicate balance with its surrounding ecosystem. As Orléans and Théret argue, since debt is the essence of society itself, any attempt to separate monetary policy from social policy is wrong (Graeber 2014; Théret 1999). Similarly, since money has an important biophysical impact, any

attempt to separate monetary policy from ecological policy is wrong (Ament 2019a). Accordingly, an ecological monetary theory address the contradiction between social and biophysical approaches to money and inform a policy framework that recognizes the mutual-emededdness of social and ecological systems.

This dissertation approaches this goal by posing a hypothesis and subsequently asking three sets of research questions.

Hypothesis: The dualism and atomism at the center of the neoclassical economic model informs a flawed theory of money that contributes to problems and obscures the systemic nature of money from orthodoxy; a non-dualistic ontology would inform a theory that is accurate and capable of offering a socio-ecological alternative to the current money system.

Research Questions:

1. How are Western ontological presuppositions manifest in neoclassical economic theory and the monetary theory that follows?
2. What is Money? How does money get its value? How does money get into society?
3. Is a system of public banking monetary reform desirable from the perspective of ecological monetary theory?

2.1 Dissertation Chapters

This dissertation consists of three papers that answer the above research questions. Through these papers, this dissertation argues for an ecological monetary theory, develops an ecological monetary theory, and applies ecological monetary theory to a public bank. The following are brief synopses of these papers.

Chapter 1: Toward an Ecological Monetary Theory

This chapter uses the framing of ecofeminist political economy to explore the ontological presuppositions of neoclassical economic theory. It argues that the dualism and atomism at the center of the Western philosophical framework manifest as the misleading conceptualization of money as a commodity medium of exchange that facilitates barter. By exploring an interdisciplinary literature, it argues that barter has never existed as an economic mode and instead, money is a social relation of credits and debts that are denominated in a unit of account. It then argues that, in order to avoid importing the dualistic ontology of neoclassical theory, ecological economics must develop a theory of money that is simultaneously rooted in an understanding of money's socio-history and in an ontology that eliminates dualisms between and amongst humans and the natural world.

Chapter 2: An Ecological Monetary Theory

This chapter develops an Ecological Monetary Theory by drawing upon an interdisciplinary literature to ask three closely-related questions: What is Money? How does money get its value? and How does money get into society? In answering these questions, this paper argues that money's nature is an abstract unit of account for

denominating credits that are capable of expiating all debts public and private. This definition embodies a social relation and conceives of money as the foundation of value. Specifically, it conceives of value as a function of money's constitution as a social-ecological relation.

This chapter is primarily concerned with the contradiction that money is an abstract social relation with a tangible biophysical impact. It addresses this contradiction by offering a two-tiered theory in which money's social and biophysical realms are mediated through an ontology of embeddedness. By rooting itself an ontological framework of ecological economics and ecofeminsm, this chapter argues that ecological monetary theory is better equipped than both social and material theories of money to address the problems of the modern money system.

Chapter 3: Applying ecological monetary theory to a public banking system of sovereign money reform

This dissertation's final chapter uses the ecological monetary theory developed in Chapter 2 to test the desirability of a public banking proposal. A public bank would give the full prerogative of money creation—and the benefit of seigniorage that comes with it—to the State. This would allow the government to create money for social and ecological purpose and destroy money through taxation in order to maintain the value of money. This chapter determines that, given certain parameters dictated by an ontology of embeddedness, a public bank is a desirable alternative to the current monetary system.

Since each chapter builds upon the previous—arguing for, developing, and applying ecological monetary theory—and since each chapter will be a standalone article, there is overlap between the chapters. Overlap is minimized to the extent possible in order to present new information. The overlap that remains is a function of crafting an argument with the assumption the reader has not read previous articles.

Chapter 1: Toward an Ecological Monetary Theory

Abstract: Money is the most ubiquitous institution on the planet and lays the foundation for human civilization. As such it should underlie economic theory. Due to the dualized nature of Western culture, however, mainstream economic theory assumes that money is simply a value relation to make barter efficient. This theory is manifest in orthodox monetary theory and policy. Ecological economics understands the problems attendant to modern money but has heretofore not developed a theory of money of its own. In order to make its economic theory and policy prescriptions viable, this paper argues that ecological economics must develop a theory of money that is simultaneously rooted in an understanding of money's socio-history, and an ontological reimagining of dualized Western culture.

Keywords: monetary theory; ecological economics; ecofeminism; dualism; monetary policy; state theory; credit theory

1. Introduction

Western society and culture are characterized by hierarchical dualisms in which reality is divided into superior/inferior pairs [1,2]. This manifests itself in mainstream economic theory as an atomistic, mechanistic model that denies input dependency on the one hand and focuses on geometric equilibrium on the other [3] (p. 277). In order for this atomistic model to function, money must be treated as a neutral commodity that facilitates barter exchange [4] (p. 49); [5] (p. 277). Accordingly, any socio-historical

dynamics or spatiotemporal asymmetries must be denied. The policy attendant to the orthodox understanding of money acquiesces control of the money supply to commercial banks [6] who are assumed to act as neutral arbiters of barter-based money. Such a profit-driven money supply engenders ecological and social consequences as wealth is transferred from borrowers to rentiers [7] and resources are extracted to support the money supply.

Ecological economics provides an alternative to mainstream economic theory by acknowledging that economic processes are energetic processes that are subject to entropy [8]. Frederick Soddy, one of the field's intellectual progenitors [9] (p. 297), drew a distinction between entropic physical wealth and money as a non-entropic virtual representation of that wealth [10]. Daly, influenced by Soddy, has argued that without fundamental changes in our approach to money, the ecological economic alternative "may prove insufficient" [11] (p. 407). Yet, as of this writing, ecological economics has not developed a theory of money.

Stepping outside of the mainstream, heterodox, and ecological economic spheres reveals a broad monetary literature that argues that barter-based economies have never existed [12] and, far from being neutral, money is the most social institution on the planet [13] [14] (p. 202). Combining money's socio-historical importance with the dualism implicit in Western culture, this paper's central argument is, thus, three-fold. First, since the barter assumption is historically false: the ecological economics critique is most effective when levied at this central failing of the mainstream model. Second, since money as an institution is a foundation of human civilization, it must play a central role

in economic theory. Third, a theory of money should be rooted in an explicit rejection of dualism.

Economics is the weakest foundation of the ecological economics transdiscipline due in part to its absent theory of money. A sound theory of the economy embedded in society embedded in the biophysical must rest on a sound theory of money [15] (p.5). It is inefficacious, however, to attempt to understand the impacts of money without first understanding the atomism at the center of orthodox economic and monetary theories. Accordingly, in order to provide a viable alternative to mainstream economics, ecological economics must develop a foundational theory of money that is simultaneously rooted in a social understanding of money and an ontological re-imagining of the relationship amongst and between humans and nature. Without such a theory of money, ecological economics risks importing flawed monetary theories and dualistic social/ecological ontologies, and accordingly, proposing inefficacious and contradictory policies. Botanist Edred Corner wrote that "the value of theory is proved by what cannot be done without it" [16]. An ecological monetary theory is valuable for its ability to provide the economic foundation that has heretofore been missing and upon which ecological economics' theories and policies may efficaciously rest.

2. Western Ontology as a Mechanical Dualism

Ecofeminism provides a useful framework from which ecological economics can address the "ecological destructiveness of the Western socioeconomic system" [17] (p. 16). As a trasndiscipline, ecofeminism understands gender, race, class, and natural

oppression as rooted in the dualistic structure of Western thought and culture [2] (p. 248) [17,18].

Dualisms organize reality into hierarchically ordered pairs [1] (p. 129) [18] (p. 47) and are constructed around oppressive conceptual frameworks that justify the subordination of the inferior [19] (p.128), distinguishing dualism from dichotomy [18] (p. 47). Accordingly, women, nature, the body, and marginalized groups are constructed as inferior and subordinate to men, culture, the mind, and powerful groups, respectively. As Plumwood argues, dualism embeds hierarchy by denying the superior's dependency on the inferior, objectifying the inferior in terms of its usefulness to the superior, and homogenizing the inferior group [18] (pp. 48–54).

Hierarchical dualism generally emerges with the philosophy of Plato and Aristotle in early Greece [1] (p. 129). Plato associated the feminine with the lower sphere of nature that is formless and chaotic [20] (p. 50) and treated the body as a prison from which the masculine soul can escape by attaining wisdom [21] (p. 200). Aristotle ordered form in a superior relation to matter within each body [3] (p. 13) by treating matter as the "passive recipient of form" [11] (p. 191). This works to create a divided self in which the rational mind struggles against the appetitive body and frames the notion of "purpose and function" [22] (p. 246) where inferior realms function in service to the superior's purpose [22] (p. 247).

While a servile hierarchy was explicit in the Greek frameworks, the relationship was ultimately rooted in an organic theory that viewed nature as a living being [23] (p. 452) that was the source of movement in an interdependent universe [3] (p. 11). As feudalism unraveled into mercantilism and the relationship with religious authority began

to shift, however, the idea that order was maintained through an organic hierarchy [3] (p. 193) was disrupted by way of atomistic social and political shifts [24] (p. 37). Order thus became the fundamental social and intellectual problem as philosophers, scientists, and mathematicians sought to develop a "framework based on the […] origin and transmission of motion" [3] (p. 207). Technological and mathematical innovations offered the machine as a metaphor for understanding the motion of individual entities moved by predictable and controllable external forces.

Rene Descartes drew upon hierarchical dualism to lay the foundation for a mechanistic worldview [25] (p. 278) by accepting ideas associated with order and control, and rejecting those associated with change and uncertainty. This was done by drawing a distinction between internal and external nature and transitioning Aristotle's organic soul/nature dualism into a mechanistic mind/nature dualism that denied inferior entities any features of the rational mind [18] (p. 104). Mathematics was viewed as an objective system of natural laws and thus any subjectivity or interrelation was systematically eliminated [26] (p. 175). Accordingly, for Descartes, nature, animals, and females operated by means of dead, atomistic matter that moved by external efficient causes without intentionality of their own [18] (p. 125). This structured reality along the lines of consciousness versus clockwork [27] (p. 113) and allowed disorder to be understood and controlled through mathematical objectivity [23] (p. 452).

Karen Warren argues that dualism and mechanism are not problematic themselves, but are problematic in "the way in which [they are] used […] to justify subordination" [19] (p. 128). As new technology was coalescing with new social and economic structures in the seventeenth century, the machine metaphor provided that

justification and removed any scruples associated with extraction for economic gain [3] (p. 277) [28]. This transition from the Platonic goal of attaining reason, to the Cartesian emphasis on conquest and control marks a unique turning point in Western civilization. It also reflects a changing social contract.

While Descartes was primarily concerned with natural disorder, Hobbes applied the mechanical model to social disorder. Hobbes viewed society as a machine consisting of atomistic beings united through "competition and self-interest" and governed from outside by a technician-like sovereign [3] (p. 210). Newton added to this mechanical social philosophy a mechanical physics rooted in mathematics [ibid] (p. 276). This theory embodied a strict dualism between passive, atomistic bodies that are moved by external forces [ibid] and replaced concepts of value, purpose, or spatial hierarchy with geometric stability and structure [ibid] (p. 277).

Growing from Hobbes' atomistic social theory and Newton's mechanics, Jeremy Bentham developed the philosophy of utilitarianism in which the best individual action is the one that increases pleasure and reduces pain. Since for Bentham, drawing from Hobbes, the community was the sum of its individuals [29] (p. 40), the best community action is the one that increases the net pleasure of the community, regardless of individual pain. The hierarchical dualism implicit in pleasure-seeking and pain-avoidance works, in the case of the emerging commercial capitalism [3] (p. 16), to objectify resources and labor in terms of their usefulness in delivering pleasure to the superior [17] (p. 16) [18] (p. 52).

3. Economic Theory

3.1. Classical Economics

Adam Smith's *The Wealth of Nations* reflects the mechanistic individualism that began to take root in the seventeenth and eighteenth centuries. His iconic description of a self-interested invisible hand is Benthamian in its utilitarianism and Hobbesian in its atomistic deference to a technician who controls society from above. While Smith was an "historical and humanistic" [11] (p. 28) economist, by reducing an economy to its individual parts he established the discipline of economics as a science in the Newtonian tradition [30] (p. 44) and paved the way for the economics that would follow.

Smith's work rests upon Locke's contemporarily novel argument [31] that mixing one's labor with "whatsoever he removes" [32] from nature constitutes ownership. This atomistic idea, however, fails to incorporate how removing resources from nature affects the utility of more than just the laborer [33]. Locke's utilitarian proviso that resource ownership was legitimate so long as man left "enough and as good" [ibid] for others was explicitly dualistic, arguing that "the earth and all inferior creatures [are] common to all men" [32]. As Plumwood points out, Locke's argument assumes that pristine nature is "unowned by other humans" and is a "nullity" until imbued with value by human (male) labor [18] (p. 111).

Mill's economic theory built upon Bentham and Hobbes to argue that the role of the state is external to the freedom of individuals to pursue utility "so long as that action does not harm other persons" [33]. As Maria Mies argues, however, freedom itself is necessarily a dualism because the "autonomy of the subject is based on the heteronomy

of some Other" be it nature, other humans, or the subordinated parts of the self [34] (p. 223).

3.2. Neolassical Economics

During the 1870s economists began to apply Newtonian mechanical mathematics [35] (p. 45) to the classical theories of political economy [36] (p. 102). Since "mathematics can only work with what can be formalized" [11] (p. 31), however, mechanical economics subordinated nature and the corporeal body to create an economics focused on "the mechanics of utility and self-interest" [37] (p. 21). Drawing from Bentham and Mill, Pareto defined economic efficiency as a socially optimal allocation of resources in which it is impossible to increase one person's utility without diminishing another's [38] (p. 247). Since interpersonal comparisons of utility are impossible, however, price became a proxy for utility preferences [ibid] (p. 248).

Léon Walras formalized Pareto's economic theory in a mathematical model of a pure barter economy. In the Walrasian model, atomistic economic actors exchange market commodities according to endogenous utility preferences and budget constraints until Pareto efficiency is achieved. If prices perfectly capture all relevant information about the utility and profitability of commodities and inputs, respectively, perfectly competitive markets will exactly duplicate the Pareto efficiency of a pure barter system [39] (p. 209) [40] (p. 2). Accordingly, social welfare, as defined by utility and profit, is maximized in competitive markets where the downward sloping demand curve of consumers is in equilibrium with the upward sloping supply curve of producers.

John Hicks applied the Walrasian model to Keynes' General Theory [41] to create a neoclassical macroeconoimc equilibrium model [13] (p. 509) [42] (p. 154). In this model, the relationship between interest and income that makes savings equal investment (IS) and fluctuates the demand for money (LM) maximizes social welfare where IS and LM equilibrate in price/quantity (interest/income) space. In disaggregating the money market from the productive market, the IS-LM macroeconomic model adopts the atomism and price rationality of the Walrasian microeconomic model.

3.3. Orthodox Economics as Dualistic Ontology

While modern economists have added criterion to the Walrasian microeconomic and the IS-LM macroeconomic models, their fundamentals continue to dominate academic and policy spheres [43] (p. 489) [44]. As Gowdy writes, "this system has held sway for so long [because] it is […] a logically consistent representation of Adam Smith's Invisible Hand" [40] (p. 69). In order to mechanize Smith's and Hobbes' observations about self-interest and social equilibrium, however, strict assumptions about, and abstractions from, reality were required. Those assumptions rest upon (1) a Cartesian dualization in which all that is not human and masculine is backgrounded in service to that which is, and (2) a Newtonian atomistic mechanics in which complexity and interdependence is superseded by equilibrium-seeking geometrical structures. The entire system, micro and macro, hinges upon the price mechanism equilibrating supply and demand. Since price-revealed utility preferences are the only preferences of import, however, and since utility is only generated through consuming and producing commodities, price comes to dominate social and ecological systems [45] (p. 92). By

constructing price this way, the neoclassical model creates a dualization "between different spheres of human behavior" [30] (p. 33) and atomizes the interdependence of social and ecological systems.

This dualization fails to account for labor and natural resources, outside of their respective market prices, in the derivation of supply and demand. The model homogenizes the circular, wage, and slave labor embedded in commodities and productive inputs [46] [47] (pp. 46–55) and disembodies labor from its biological function [1] (p. 130). From a resource perspective, commodities are viewed in terms of a "mechanistic ontology" [48] (p. 11) with no inherent value until labor or capital actualize their value in the form of producer profit or consumer utility [11] (p. 192) [18] (p. 111). The assumption that all individuals and firms are "atomistic agents" [40] (p. 48) whose utility functions are independent of one another and independent of the commodity's own utility [49] (p. 14), denies social [50] (p. 953) and ecological [33] interdependence. Similarly, the asocial and finite exchanges between the model's barter actors obscures the embodied social relation implicit within exchange [51] (p. 36). Yet, these unrealistic and atomistic assumptions are necessary in order to achieve mathematical equilibrium [40] (p. 18) and model economic science after the Newtonian paradigm of mechanical dynamics [52] (p. 17).

4. Money

4.1. Money in Orthodox Theory

4.1.1. Price Numeraire as Value Relation

In the Walrasian model, price acts the single tool through which all information about commodities is revealed while also serving as the single feedback loop that equilibrates supply and demand. Price, however, is not money per se, but a measure of the relative utility between two "existing commodity values" [14] (p. 18) and a third commodity of invariable value that Walras called the numeraire [53] (p. 215).

An "omnipotent auctioneer capable of knowing all exchange and utility values at all times" [54] (pp. 31–32) sets the numeraire price to one and it becomes the price relative to which all other prices are interpreted [55] (pp. 26, 613). But price is not money. It is the relative utility value of commodities that establishes market equilibrium and allows the first fundamental theorem to state that if prices perfectly reflect utility, a competitive market is the same as barter.

4.1.2. Classical Materialism, Neoclassical Neutrality, and Medium of Exchange

For the classical economists, value was inherent in land, labor, and the production process [54] (p. 30). Aristotle and Smith both argue that money is an outcropping of the process of individuals bartering in value. For Aristotle, barter temporally merges purchases and sales into one transaction [56] (pp. 26–27). For Smith, specialization causes merchants to spatially lack what they need while holding an excess of what they create [57] (p. 21). The temporal and spatial inconveniences of barter leads to the classic "double coincidence of wants" problem wherein, during a transaction, both individuals must simultaneously have the good the other wants and want the good the other has [58] (p. 32).

To avoid this problem, the story goes, people began to hold certain commodities that "few people would be likely to refuse in exchange for the produce of their industry" [57] (p. 21). Precious metal, in this view, being both universally acceptable and divisible, naturally emerged as money, and was "singled out as the commodity through which all barter must occur" [29] (p. 360).

In other words, money is a medium of exchange that represents underlying commodity values, though without any value itself, and allows economic agents to store value in time and space—to lubricate the gears of trade [13] (p. 508). This explains why Walras' price represented relative value, not money. It also explains Mill's argument that "money […] does not interfere with the operation of any laws of value" [59] (p. 341), and Say's contention that "products are paid for by products" [60] (p. 178), "and when the transaction is […] closed […] one […] commodity has been exchanged for another"[ibid] (p. 138).

Contemporary mainstream economics views money the same way as Walras, Smith, Mill, and Say. Samuelson wrote that "money is a neutral veil that obscures barter transactions just below the surface" [4] and argues, were it not for the inconvenience of barter, "money […] might have little function" [61] (p. 481). Schumpeter echoes Mill in writing that money is a "technical device that has been adopted in order to facilitate transactions […] [between] […] goods and services" [5] (p. 277). Wheelan writes that "in theory money is not even necessary" [62].

Economic theory almost ubiquitously defines money according to its three functions: a medium of exchange, a store of value, and a unit of account. Given the barter-commodity theory of money's origins, however, medium of exchange is treated as

the “key function” from which all others follow [14] (p. 24). The notion that money is engendered primarily as a medium of exchange that arbitrates the price–value relation between commodities gives rise to the concept of monetary neutrality that Schumpeter explains as the idea that money “does not affect the economic process, which behaves in the same way [with money] as it would in a barter economy” [5] (p. 277). The Arrow–Debreu General Equilibrium model formalized this theory by showing that markets will gravitate toward an equilibrium price without the existence of money. Since the model can reach equilibrium without the existence of money, it was used as proof that “money was extraneous to worthwhile economic analysis” [63] (p. 214) and is effectively rendered redundant by the price relation [14] (p. 18). It is here that the commodity theory, the barter origin, the medium of exchange primacy, and the price–value relativity come together to inform modern economic theory and its attendant policy prescriptions, most importantly, modern money creation.

4.1.3. Neoclassical View of Money Creation

John Locke was a scientific materialist who, much like Hobbes, saw human behavior as founded in natural laws from above. For him, money’s durability and force for economic growth circumvented the two limits of his theory of private property, i.e. spoilage and sufficiency, respectively [64]. In his tenure as Warden of the British Mint, Locke advised Newton to recall and reissue coins of deflating value because the social value imbued in the coin was less important than the State-verified weight of the coins’ silver for which merchants, in his view, actually contracted [30] (p. 340).

This idea that the role of the state is to maintain measures in order that commodity money may be allocated amongst market actors informs the orthodox view of money and banking. According to orthodoxy, money grew out of barter and banking grew out of money [30] (p. 40) [65] (pp. 80–85), each of the latter responding to the temporal and spatial incongruences of the former. It follows that banks function as intermediaries between savers (lenders) and investors (borrowers), as made explicit in the equilibrium-seeking IS-LM model. Krugman and Mankiw both argue that banks lend to investors what savers have "stashed" with the bank after cutting back on spending [66,67] [68] (p. 260).

Since money cannot exist at the same time as both a saver's deposit and a borrower's loan, banks must create money when they extend saver's money as credit to borrowers [69] (p. 1339). The compromise is the fractional reserve system of bank lending [70] (p. 36) that mainstream economists understand through the concept of the money multiplier. In this view, banks wait for exogenous central bank money in the form of deposits and extend it to borrowers in the form of loans, keeping a fraction as reserves in the vault should depositors wish to access their savings [68] (p 332). The fraction of total base money that a bank holds is called the reserve ratio; its reciprocal is the money multiplier or the factor by which banks create money through the process of lending [ibid] (p. 334).

The money multiplier model of lending upholds the orthodox view of money by implying that the Central Bank:

1. Provides initial base money that savers deposit, and

2. Maintains a liquidity-ensuring reserve requirement such that banks lend a multiple of the base money up to a
3. Mathematically-defined limit equal to the reciprocal of the reserve requirement [54].

These implications rest on the assumption that banks are atomistic actors that efficiently mediate neutral commodity money between other atomistic actors (savers and borrowers) in markets that are facilitated by, but without a significant role for money [54] (p. 31). In this view the Central Bank is Hobbes' and Smith's exogenous higher power that issues base money and sets reserve requirements in order that the barter transactions below the surface [4] do not get "out of control" like Mill warned was the only way for money to cause a problem [59] (p. 341).

4.2. Problems with Money in Orthodox Theory

4.2.1. Abstract Value as Value Relation

Walras' price numeraire as a "symbolic representation of existing commodity values" [14] (p. 18) and the subsequent orthodox conflation with a commodity that represents that symbolic representation presents a philosophical challenge. As Ingham notes, the exchange rate possibilities between even a small number of goods are insurmountable [14] (p. 25). Walras sidestepped this shortcoming by introducing his numeraire. Since a numeraire is a comparison of commodities themselves, however, the money commodity that arises to represent their relation is at once a commodity itself and a special representor of commodities [71] (pp. 15–16). This dual quality leads to considerable problems with the formulation of money's value [ibid] (p. 16), including its ability to arise as a unit of account from a medium of exchange [14] (p. 24), and its value as a

relation to the community as a whole [72] (p. 177). These difficulties go far in explaining why money in orthodox theory will not have value [73] (p. 136) and must, accordingly, be treated as neutral.

Simmel escapes the logical trap that a direction comparison numeraire presents by arguing that measures need not, and most often do not, exhibit the same quality as the objects they measure [72] (pp. 131–132). Thus, money, while acting as a "stable pole" [72] (p. 121) of relative commodity values, does not represent the relation between those commodities, as a numeraire does, but rather, points to their relative relation to a third quantity [72] (p. 146). This quantity is an abstract value that constitutes a social relation and is starkly different from a "direct comparison" [ibid] of two quantities. In other words, abstract value allows for comparison, but is not the comparison itself.

Michael Hudson argues that "the essence of money is not to be sought in the material form from which it was made, but in the fact that it provided a common denominator to co-measure prices" [74] (p. 124). This co-measure is not a direct-relation numeraire, but a reference to an abstract value that allows for the orchestration of systems of debt and credit between and amongst trade merchants [75], economic agents, and the public institutions [74] (p. 117). This will be explored now.

4.2.1. Logical and Historical Inaccuracies of Barter, and Unit of Account

As shown above, mainstream economic theory rests on the assumption that individuals ultimately trade commodities for other commodities [76] (p. 49) and that money as a commodity-based value relation solves barter's double coincidence of wants problem. The problem is that there is "no evidence that [barter] ever happened, and an

enormous amount of evidence that it did not" [30] (p. 28). As Caroline Humphrey writes, "all available ethnography suggests that there has never been such a thing [as an economic system of barter] […] let alone the emergence from it of money" [12] (p. 49).

Logically, the barter story is also inconsistent. The idea that merchants would specialize until they held a surplus of one good while lacking all other goods is not only inconvenient, it is impossible. Seasonality and production stages further complicate the barter story [75] (p. 130). As Ingham writes: "money is logically anterior and historically prior to market exchange" [14] (p. 25). Rather than emerging as a medium of exchange from bilateral barter transactions, the evidence argues that money exists as an abstract unit of account to denominate debt relationships between merchants on alternating production cycles and between those merchants and the State [75].

A. Mitchell Innes argues that Adam Smith's oft-cited account of barter was based on a mistaken understanding of the trade dynamics in Scottish and Newfoundland villages where nails and cod were used to purchase food and supplies, respectively. While nails and cod appeared to Smith as the commodity through which barter occurred, the transactions were in fact denominated "in pounds, shillings, and pence" and were exchanged for "a credit on [the customers'] books" [77] (p. 378). What Smith believed to have been a "tangible currency" [77] (p. 378), in each situation he had found credit denominated in a unit of account enforced and upheld by the State [78] [79] (p.87).

A rich body of literature explores this dual state/credit nature of money as a manifestation of a complex and evolving social contract between and amongst individuals and the State. Credit theory argues that the barter story lacks an account of debt's role in establishing money [80] (p. 57). While Aristotle argued that commodity

money solved the temporal incongruence of sales and purchases, Innes removes the tangibility of the medium and argues that a creditor's right to later payment solves the problem [78] (p. 152). For thousands of years before metallic money forms, it was these debt/credit relationships between economic actors in commodity exchange and social actors in wergild relations that formed the basis of money's nature [24] (p. 61) [30] (p. 40). While barter relations are ephemeral and asocial, Polanyi shows that economic exchanges are in fact embedded within social relations of owing and being owed [24] (p. 50). Gardiner argues that systems of credit and debt are "the foundation of […] civilization" [75] (p. 163) and come before economies themselves [75] (pp. 130, 169). Aglietta writes "wherever anthropologists have been able to discern something that we could call an economy, money existed" [15] (p. 81). Innes argued that "credit alone is money" [77] (p. 393) and forms the basis of civilization in all places and times throughout history [77] (p. 391). These views mirror the Vedic poems of the second millennia BC in which "a man, being born, is a debt" [30] (p. 56) as well as the more recent primordial debt theorists who argue that debt is, and has always been, the essence of society itself [ibid].

State theory argues that the barter story lacks an account of the State's role in establishing an abstract standard of account [80] (p. 57) to denominate the above credit/debt relationships. Whereas Locke argued that the State's role in money was to standardize weights and measures, Friedrich Knapp's chartalist theory argued that legal ordinances, not materiality, regulate money's use [81] (pp. 1–2). In the chartalist view the State plays a dual role. On the one hand it designates a unit of account to act as money by purchasing goods and services in that unit [14] (p. 12). On the other hand it drives money

through its monopolization on the use of violence [82] (p. 42)—in this case the ability to collect taxes in the unit of account it has designated [83] [84] (p. 137). It is precisely this dual role as simultaneous supplier and demander [14] (p. 12) [80] (p. 62) that prompted Silvio Gesell to write: "Money requires the State, without a State money is not possible" [85] (p. 81).

Together, the State and Credit Theories propose that money's nature as a unit of account take primacy over money's function as a medium of exchange. It is precisely here that orthodox economic models fail: they are built upon a medium of exchange and must, therefore, determine why one commodity would be chosen as a medium of exchange over all others [63] (p. 294) [86] (pp. 126–135), something they cannot do [14] (pp. 21, 24). Innes pointed out that any solution to this predicament would be an "obvious absurdity" since the chosen commodity would be denominated in itself [77] (p. 378). This is the logical circularity at the center of economic theory and why Hayek wrote "the identity of supply and demand […] ceases to exist as soon as money becomes the intermediary" [87] (p. 130). Not only can a direct commodity relation not serve as an abstract unit of account [72] (p. 132), an abstract unit of account cannot be chosen as a direct commodity relation. Drawing upon Aglietta, any privately appropriable commodity medium would undermine, by way of its very liquidity, the exogenous utility requirement at the center of equilibrium theory [15] (p. 8). Since, as argued above, a unit of account is the primary characteristic of money, it cannot exist within a model that requires a direct-relation numeraire to equilibrate. Accordingly, the Arrow–Debreu theorem's logic that money is extraneous since it can reach equilibrium without money only holds if money is understood as a medium of exchange. When money is understood as a credit-based unit

of account, the model cannot reach equilibrium. Far from Schumpeter's argument that money does not affect the economic process [5] (p. 277), money itself *is* the economic process [15].

Pursuant to the prior two sections, this paper defines money as a unit of account in which credits and debts are denominated. This definition is important because it allows us to treat the myriad shifts between pre-economic money and modern money as major historical evolutions of a foundational social institution, rather than distinct and incomparable forms of exchange media.

4.2.3. Commercial Banks Create Money

Modern money is created when commercial banks issue loans to individuals and corporations at interest [54,58]. This 'horizontal' money makes up approximately 97% of money in the UK [88] and approximately 92% of money in the US (data from the Federal Reserve Bank of St. Louis).

While neoclassical theory assumes that banks use customer deposits when extending loans, in practice, commercial banks generate loans by increasing a borrower's deposit account *ex nihilo* equal to the amount of the loan [84] (p. 84). The bank views the loan as an asset and that is offset by a deposit liability, while the borrower views the loan as a liability that is offset by a deposit asset. The process is that simple: there was no need for a savings deposit before extending the loan and banks will extend all the loans they deem profitable regardless of deposits.

This "fountain pen money" [70] (p. 37) enters circulation when borrowers spend their credit in the economy [54] (p. 61). If a borrower spends their credit with a customer

of the same bank, a simple balance sheet operation between the customers will clear the payment. Otherwise, commercial banks use one of two kinds of Central Bank Money to clear their customers' payments: Central Bank reserves or cash [58] (p. 77).

If a borrower spends their credit with a customer of a different bank, the respective banks will exchange reserves to clear the payment. Reserves are created *ex nihilo* by the Central Bank in order to facilitate payments between intra-bank customers and can only be accessed by commercial banks. At the end of each day, commercial banks net their incoming and outgoing reserve positions and borrow any owed reserves from either the Central Bank or the interbank lending market.

If a borrower wishes to spend their credit without the use of a bank intermediary, they may withdraw cash. Commercial banks acquire cash from the Central Bank in exchange for reserves. While some of this cash can be retained by banks to satisfy their withdraw demands, all cash ultimately begins as a loan [58] (p. 103) and can thus be seen as a "physical representation of commercial bank money" [54] (p. 72).

This dynamic contradicts the neoclassical view of banking and explains why Mervyn King, former Governor of the Bank of England, argues that "money is endogenous […] [to] the banking system" [58] (p. 78). Endogeneity challenges the three implications of neoclassical theory.

1. Banks do not wait for deposits before making loans. Cash and reserves are always created in *response* to lending activity [54] (p.103) [89] (p. 49).
2. Reserve requirements do not limit lending to a multiple of base money that is kept in the bank's vault [68] (p. 333); they create cash and reserves as a fraction of total

lending, *ex post*, to enable liquidity between banks and individuals. A fractional reserve system does not exist.

3. Banks will always extend loans if there is a positive interest spread between the loans and the Central Bank Money needed to ensure payments clear.

4.3. Orthodox Monetary Theory and Policy as Atomistic Ontology

Money is a blind spot for orthodox theory due, largely, to the atomistic ontology at its core. Money's treatment as a neutral, commodity-based medium of exchange within a barter economy is a direct descendent of Aristotle's economic theory [90] (p. 174) and the hierarchical dualism implicit in his philosophy and its interpretation and development through time. On the one hand, atomism implies that commercial banks allocate a limited supply of money, like any other commodity, amongst consumers (investors) and producers (savers) around the price (interest) mechanism while the exogenous Central Bank maintains equilibrium. On the other hand, atomism drives assumptions about money's nature as a commodity representation of barter between individual utility maximizers [14] (p. 22).

Since a barter economy cannot be distinguished from an economy using commodity money [91] (p. 3), the application of orthodox barter theory must use commodity money and view banking as an intermediary. As we have seen, however, commodity money has never existed and banks are not commodity lenders [92] (p. 256). Money is a unit of account to denominate credit and banks are credit creators who play a deterministic role in the quality and quantity of money in the economy. Such a money economy is structurally different from a barter economy [72] (p. 178) and is "utterly

incompatible with the methodology of orthodox neoclassical economics" [14] (p. 21) that equilibrates around price rather than money.

For these reasons, mainstream economists must either deny the existence of endogenous money like Krugman [66], or argue for a monetary policy that creates the fictitious conditions for a material money like Hayek [87] (p. 130) and Lutz [93] (p. 115). It is this paper's argument that integrating the social dynamics of debt that are inherent in money itself, and assigning power and interdependence (socially and ecologically) in the monetary lifecycle, would undermine the neutral-commodity concept that is central to "the entire discourse of economics" [30] (p. 43) from both the micro and macro perspectives. From a micro perspective, money that does not represent a barter commodity distorts the fundamentals of market equilibrium, as we have seen [15] (pp. 19–22). From a macro perspective, endogenous money undermines the IS-LM model where "loanable funds" generate investment in an economy [44]. Since creating the conditions for the economy to operate like the neoclassical model would mean redesigning much of human history [63], it is prudent, rather, to "alter the model in a fundamental way" to include money [73] (p. 136).

4.4. Problems with Private Money Creation

Modern money is a manifestation of the dualism implicit in Western culture. However, due to the neutrality at the center of the orthodox model, problems attendant to money are assumed to be temporary and not structural. Money, however, is not neutral [92] (p. 159). It follows, then, that the social optimality at the center of the neoclassical model will always be undermined and the system can only ever be, in Mill's words, "out

of control" [59] (p. 341). While on the surface, the difference between credit-based unit of account and a barter-centric medium of exchange may seem trite, the monetary system resultant to that difference is at the foundation of our economic, social, and ecological problems.

As Minsky argues, an endogenous money system is inherently unstable due to the cyclicality it embodies [94]. Since the vast majority of money in circulation exists as a function of bank profit, attempts to stabilize the economy have largely proven inefficacious [58] (pp. 95–109). Government response to such cyclicality tends often to force growth, eliminate regulation, and fund profitable rather than desirable business [58] (pp. 161–162).

Further, since exogenous money must generate enough profits to cover principal and interest, socially-and ecologically-harmful activities are prioritized over sufficiency activities that are cost- rather than profit-based [95]. Socially, credit-based money systematically transfers wealth from borrowers and renters to lenders and rentiers [7] (p. 161). This is especially true when investment returns outpace economic growth [96]. Sociologist Michael Mann argues that money's usefulness as a facilitator of cooperation across space can be appropriated by particular interests that control, not only the quantity of money, but more importantly, its production [14] (p. 4).

Ecologically, since debt-based money must always grow [97,98], heavy strain is put on ecosystems to continually produce goods lest the economy crash. This problem is not unique to goods since services also, necessarily, have a physical dimension [11] (p. 412). While for Locke, money's durability eschewed the limits of his proviso, Soddy [10]

and Gesell [85] were both concerned with the entropic contradiction of an abstraction that commands physical resources.

5. Ecological Economics

5.1. Ecological Economics

Ecological Economics provides an alternative to orthodox economic thought by offering a theoretical critique of equilibrium theory while embedding the economy within a biophysical reality. The field views humans as other-regarding social animals with interests outside of selfish utility maximization [99] (p. 1224) [100]. Accordingly, it holds that the axioms of consumer choice that form the backbone of neoclassical theory break down as social systems co-evolve with ecological systems [40] (p. 109) [101]. Ecological economics also argues that the price mechanism is an ineffective feedback loop [102], especially for the vast array of non-market goods and services [103] (p. 35).

Outside of its behavioral-mathematical critique, ecological economics embeds the economy within the biosphere [104] (p. 50) by contending that economic processes are energetic processes that are subject to entropy [8]. While mainstream economics views the economy as a circular exchange relationship between firms and individuals, ecological economics is concerned with resource inputs and waste outputs [105] and the qualitative transformations of commodities in its understanding of the economy [11] (p. 35).

Ecological economics is also a normative discipline in which ethical considerations are made explicit [106] (p. 46). Daly argues that resources should be depleted on grounds of "ethical desirability" rather than profitability [107]. Brown and

Erickson argue that “the foundations of both political and economic liberalism must be rethought from the ground up” [108] (p. 46). The field thus aligns well with the ontological presuppositions of ecofeminism [109] and its critique that modern economies are dualized in ways that fail to adequately acknowledge the labor and resources upon which they rest [47] (p. 54). A special edition of the journal considered this alignment by exploring the dualistic behavioral assumptions of equilibrium theory [1], the subject/object dualism implicit in production theory [110], and the social and ecological destructiveness of a dualized economic theory [111] (p. 164). Ecological economics has not broadly, however, addressed these dualisms [112]; specifically, how they manifest in orthodox monetary theory and therefore in the field’s own understanding of, and approach to, money.

5.2. Money: Ecological Economics’ Blindspot

As a transdisciplinary school, ecological economics draws upon other disciplines [39] in order to address “the substantive failures of orthodox economics” [106]. This paper uses sociology, geography, anthropology, and ecofeminism in order to address what I contend is the central failing of the neoclassical model: the notion that money is a neutral outcropping of barter trade.

While ecological economics certainly understands the importance of money generally [10] (ch. 7, p. 2) [113] (p. 91) and money creation specifically [11] (p. 407) [114], it has nevertheless largely ignored monetary theory [115] (p. 258). Accordingly, the field makes two mistakes. First, it misses the most central critique of neoclassical school: that barter exchange is structurally distinct from money exchange. Since even

"the best model of the economy cannot find room for [money]" [86] (p. 1) without a monetary theory, ecological economics risks, like the orthodox school, assuming either that money does not matter or that its analysis can come after economic theory. Second, by failing to develop a theory of money for itself, ecological economics has borrowed from other disciplines, causing errors (the barter myth) and inconsistencies (ontological overlap) in its analysis, to be explored, respectively, now.

5.2.1. The Barter-Commodity Myth In Ecological Economics

The introductory text by Farley and Daly explains that individuals hold money in order "to avoid the inconvenience of barter" [116] (p. 288). Daly writes in For the Common Good that "barter […] is the simplest and oldest method of exchange" [11] (p. 409). While Daly and Farley now reject this view, as a field, the barter-commodity myth persists. Lawn writes that "money […] allows you to overcome the inconvenience […] of bartering" [117] (p. 932). Roma uses an energy-numeraire money to develop a thermodynamic production equilibrium, arguing that commodity money has been the economic standard for thousands of years [118] (p. 544).

In fact, the journal does not, to my knowledge, contain a single article that challenges the barter myth [119]. It is my explicit argument that, since an economic system of barter has never existed, failing to challenge the idea of barter risks implicitly integrating a commodity numeraire into theory and ignoring the critical role of money in the economy. Further, failing to understand the role that states and corporations play in establishing a monetary system while ignoring the intricate relationship between gendered socio-ecological power dynamics, debt, and money [47] (p. 132) [80] (p. 57)

has significant implications for any conclusions that may be drawn from an analysis of money.

Resultant to the barter myth, Daly writes that "banks cannot create money under 100% reserves [since] the reserve deposit multiplier would be unity" [120]. In fact, banks can create money under 100% reserves, especially if all banks move in lockstep [121] and/or the banking industry is dominated by a few large banks [54] (p. 68) [58] (p. 99).

My goal here is neither to criticize Daly nor to be trite over word choice. It is to argue that a multiplier unity assumes that banks lend savings and ultimately rests upon an understanding of banks as intermediaries between bilateral barter exchanges. Daly's argument, as he clearly articulates, is that banks cannot create money when banking is separated into deposit holding and savings lending [122] (p. 9). It is therefore not the reserve requirement that limits money creation. It is (1) the separation of banking activities [14] (p. 114), and (2) the requirement that savers and borrowers cannot use the same money at the same time [123] (p. 19). While this distinction may seem small, the policy implications between reserve requirements and separate banking activities are radical.

5.2.2. The Weakness of a Post-Keynesian/Ecological Economic Monetary Synthesis

Ecological economics' lack of a foundational monetary theory means that the school has long drawn on a post-Keynesianism monetary framework "given [the schools'] methodological overlap" [124] (p. 182). This is especially true of Jackson and Victor [125] and Miller [126]. The reverse is also true, with post-Keynesians such as

Fontana and Sawyer [127] and Lavoie and Cahen-Fourot [128] publishing monetary pieces in the journal.

This synthesis, however, should be undertaken with caution as it "leaves unanswered how scientific progress is meant to be achieved" [106] (p. 42), and fails to incorporate ontology and epistemology [ibid] (p. 45), deferring instead to methodology alone. By integrating the work of other disciplines, one implicitly ascribes to their ontological and epistemological presuppositions. Miller argues that while there are some frictions regarding growth and scarcity between post-Keynesianism and ecological economics, those "ought not […] stand in the way of […] [a] monetary synthesis" [126] (p. 14). This conflates methodology with ontology and epistemology and fails to recognize that if those frictions are a function of conflicting ontologies or epistemologies, we should be justified in our skepticism of the progress we draw from works with which we might otherwise methodologically agree (for example [69,128]).

This chasm can be seen in Rezai and Stagl's argument that by drawing from post-Keynesianism, ecological macroeconomics "has made significant progress […] [in] understanding […] current macroeconomics" [124] (p. 182). It is certainly true that post-Keynesians understand money in a productive capitalistic economy very well. Ecological economics broadly, and this paper specifically, however, argue for an ontology that runs counter to a productive capitalistic economy. Our progress should be measured as much by our understanding of how macroeconomies *do* work as by how they *should* work. Perhaps those who propose a "post-Keynsian ecological macroeconomics" [127] while labeling some in our field "monetary cranks" [69] (p. 1346) do not distinguish between "analytical errors" [ibid] (p. 1346) and epistemological difference.

Lavoie and Cahen-Fourot's [128], and Jackson and Victor's [125] consideration of capitalistic money in a steady state economy further highlights this difference. Each of their models implicitly define a steady state quantitatively rather than qualitatively, an energetic distinction that ecological economics is eager to draw [8] (p. 350). Similarly, both models fail to integrate the "distributional issues" [128] (p. 167) of a system of private money creation and "capital accumulation" [ibid] (p. 167). For example, stock-flow consistent methodology fails to draw a distinction between those who own assets and owe liabilities [14] (p. 81). Further, each model requires that banks do not accumulate profits in the course of their credit creation, a requirement that runs counter to the profit motive behind commercial bank lending in the first place [90] (pp. 107, 197). Since the ultimate goal of a steady state is not capital accumulation, both models prove by contradiction what they claim to have disproven by methodology, i.e. since a steady state that uses capitalist money cannot be capitalist, a steady state cannot exist with capitalist money.

Accordingly, the relationship between our schools should be one of synthesis rather than transplant. This is not to say that post-Keynesian economists are wrong or that ecological economics should not draw on the discipline. They are not and I do—especially Wray [129]. But ecological economics requires a monetary theory of its own, rooted in its own explicit ideology. Where there is overlap, it should be welcomed. Where there is friction—in either ontology or epistemology—ecological economics must stand on its own as a school of monetary thought.

5.3. The Sociality of Money

Odum [130] and Røpke [9] (p. 296) have each drawn upon process philosophy to argue that the closed nature of the Walrasian model fails to incorporate the fact that economic processes are ultimately ecological processes. Exending this argument, economic processes are also social processes, drawing from and contributing to the social context within which they find themselves. Ecological economics has existed thus far in a largely energetic-biophysical conception. While many examples exist [131–134]—and notwithstanding the ever-present goal of just distribution—the field has not incorporated writ large the social embeddedness of economic processes. This is especially true in the case of money, the most social of all human inventions [135] (p 47).

Money is more fundamental and ubiquitous than any institution on the planet. Research suggests that it shaped our cognitive processes and gave rise to literacy, mathematics, and sedentary community [63]. Ingham writes that "monetary systems are the result of the long term historical development of a complex structure of social relations" [13] (p. 516). Simmel argues that money is a claim upon society [72] (p. 176). Money is quite literally the institution upon which society rests.

Accordingly, any attempt to consider social policy—and by extension, environmental policy—in isolation from monetary policy will fail because, as primordial debt theorists argue, they "have always been the same thing" [30] (p. 56). Many of the shortcomings of ecological economics' approach to money, and the school's inefficacy in influencing policy or discourse in a meaningful way, can be resolved if money is defined as a unit of account and "conceptualized as a structure of social relations" [13] (p. 507).

As said before, failing to do so traps ecological economics in either the (1) "economic principles first, money second" camp, or the (2) "money is a value numeraire" camp.

The dearth of import that Ecological Economics assigns to the topic of money generally, but to its sociality especially, is exemplified by the fact that neither A. M. Innes nor Friedrich Knapp are ever mentioned or cited in the journal's history. (Notably, Mellor [47,135] Dittmer [136,137] do cite these authors in other journals.) Geoffrey Ingham is mentioned once [122], and Georg Simmel and Michel Aglietta are mentioned in the context of social order and capitalism, respectively, but never money. Among others, these thinkers form the indispensable backbone of monetary theory.

5.4. The Gendered Basis of Money

Neoclassical economic theory inferiorizes resource and labor inputs. While ecological economics has been largely rooted in its critique of the former, the latter, especially vis-à-vis gender, is a complementary critique without which the former falls short [18] (p. 13). Accordingly, much like ecological economics has not fully explored the social embeddedness of economic systems, it has not fully explored the gendered dualization of those systems. Mellor argues that ecological economics' critique "would be greatly enhanced if it were to recognize the links between the […] exploitation of the natural world and women's labor" [134] (p. 122). This is especially true in the case of money.

As explored above, money forms the foundation for society itself [77] (p. 391) and represents an individual's claim upon society [72] (p. 176). In a hierarchically gendered society, however, domestic and communal work is largely excluded from the

money sphere [70] (p. 158) and the social claims that entails. From an ecological perspective, money is a license to extract resources [113] (p. 78) [138] (p. 141). Again, in a dualized society, resources fail to reflect the gendered reproductive and cyclical labor explicit in their extraction.

Much like its broader critique has existed largely in a biophysical realm, ecological economics has heretofore attempted to understand money from the perspective of entropy [10,11,64]. However, since money is "brought into being through a combination of private, public and social acts [and becomes] a claim on resources and labour" [70] (p. 159), the gendered dynamic of the labor embodied in those social and ecological dynamics must be equally considered [139] (p. 255). Without doing so, Mellor further argues, "ecological economics risks importing gendered assumptions into its theories and proposals" [134] (p. 122).

6. An Ecological Monetary Theory

Since money is a social relationship that forms the basis of human civilization [15] (pp. 39–40) [75] (p. 163), ecological economics must develop a foundational theory of money upon which alternative economic theory and subsequent social and environmental policy may rest. And since, as we have seen, orthodox monetary theory and mainstream monetary policy is rooted in a dualized social and environmental relationship, an ecological monetary theory should be rooted in an alternative to that dualism. Accordingly, this paper argues for three requirements of an ecological monetary theory: reject the barter myth, articulate money as a social relation of debts and credits, and adopt an ontology in which hierarchical dualisms amongst and between humans and

nature are eliminated. Such an approach aligns well with Ingham's call for an "ontology of money" [13] (p. 509). It also provides an effective tool through which ecological economics can examine policy and policy alternatives without implicitly adopting the ontological presuppositions of other theories. As of this writing, this has not been done.

Spash argues that "consumer theory should be consistent with human behavior and production theory should be consistent with biophysical laws" [133] (p. 357). I extend his argument here, positing that since human behavior is embedded within an ultimately debt-based sociality [15] (p. 39), and money is a dualist claim on biophysical resources [139] (p. 255), an ecological monetary theory should form the basis of ecological economics' consumer and producer theories. As Aglietta writes, "if we consider the economy as a subset of social relations," something ecological economics explicitly does, "then we need a political economy founded on money" [15] (p. 5).

Moreover, if ecological economics bases its macroeconomic theory in monetary theory, it will have a strong base upon which to address current macroeconomic issues such as finance, distribution, and welfare [124] (pp. 182–184), where the opposite is not true. Accordingly, ecological monetary theory and ecological macroeconomics should not be confused. Rezai and Stagl [124] (p. 183) make this mistake when presenting the nature of money as the debate between exogeneity and endogeneity, rather than an exploration of money's nature as a unit of account to denominate credit [14]. Further, ecological monetary theory should not be understood as a subset of ecological macroeconomics, as Lavoie and Cahen-Fourot contend [128] (p. 163), but as a foundation of both ecological micro- and macroeconomics.

The case of modern money is an example of why rooting economic theory in monetary theory is prudent. Modern money can be understood as a merger of the State and Credit Theories wherein the vast majority is created by commercial banks when they extend credit that is denominated in the State's hegemonic unit of account and facilitated by fiat Central Bank money [80] (p. 65). While this contradictory existence has been at the core of monetary economies for thousands of years, it is currently the result of the tension between the orthodox commodity theory of money on the one hand, and the complex social nature of money on the other. Addressing this contradiction requires us to understand that modern money is indeed money, but is also a reflection of our socio-ecological values [90] (p. 183). Thus, while Knapp argued that it is the acceptance, not the issuance, that defines money [81] (p. 95), ecological monetary theory can add that since issuance reflects our values, how we create and spend money should form the base of how ecological economics' micro and macro theories will articulate consumption, production, inequality, and growth. As Ingham writes, "once money has been produced, then economic analysis is applicable" [14] (p. 198).

An ecological monetary theory must therefore exist somewhere between a critique of modern private-debt money on the one hand, and an acceptance of the social-debt money that has existed for thousands of years on the other. In other words, critiquing modern money on the basis of its existence as a credit/debt relationship fails to integrate the fact that all money in all times has existed that way [30] [75] (p. 163) [78]. This space is filled by an explicit differentiation between public and private credit and debt, and the ontological presuppositions that come with that differentiation. Articulating public debt as social equity [140], for example, may bridge this critique-acceptance gap.

A non-dualized ecological monetary theory based in an historical understanding of money's origin as debt, could form the foundation of an economy that is consistent with the pre-analytical vision of ecological economics. This would strongly contrast the fundamentally unstable modern money supply and support Douthwaite's idea of a money system that continues to function in the absence of growth [98] (p. 27). It could also articulate the quality of money in circulation as well as its quantity. Further, it allows us to address the biophysical problems that sociological theory does not, and the social problems that a biophysical theory cannot. Finally, an ecological monetary theory can act as a filter through which past, current, and proposed monetary systems, as well as their respective critiques, may be considered.

6.1. Conclusions

Western culture is dualized in a way that justifies the subordination of nature and women. This dualization leads to an economic theory that is atomistic and mechanistic, and, accordingly, must treat money as a neutral reflection of barter. In reality, however, money is historically the most social institution on the planet and modern money is created according to dualistic power structures.

Ecological economics offers an alternative to mainstream economics that embeds the economy in the biosphere. Since it has not critiqued the dualism at the center of the mainstream model, however, it lacks the gender critique that is the environmental critique's necessary complement. And while the school has argued that money is a critical issue, failing to address dualism risks incorporating the barter myth into its own analysis and treating money as secondary to economic theory.

This paper has argued that since money forms the basis of civilization, economic theory should be rooted in monetary theory. Moving forward, ecological economics must develop an ecological monetary theory that is rooted in an understanding of money's socio-history and explicitly addresses the dualistic nature of Western socioeconomic and monetary systems.

Funding: This research was supported by the Economics for the Anthropocene project. It was funded by The Social Science and Humanities Research Council of Canada; Gund Institute for Environment at The University of Vermont; and The Rubenstein School of Environment and Natural Resources at The University of Vermont.

Acknowledgments: I would like to thank Ole Bjerg, Pablo Bose, Peter Brown, Ben Dyson, Jon Erickson, Joshua Farley, Brendan Fisher, John Fullerton, Joseph Huber, Mary Mellor, Ellie Perkins, Joshua Ryan-Collins, and Romain Svartzman for their inspiration—known or not—throughout the inception and creation of this paper. All mistakes are mine alone.

Conflicts of Interest: The author declares no conflict of interest. The funders had no role in this research or writing.

References:

1. Mellor, M. Women, nature and the social construction of 'economic man.' *Ecol. Econ.* **1997**, *20*, 129–140.
2. Gaard, G. *Ecofeminism: Women, Animals, Nature/Edited by Greta Gaard*; Temple University Press: Philadelphia, PA, USA, 1993; ISBN 978-0-87722-988-9.

3. Merchant, C. *The Death of Nature: Women, Ecology, and the Scientific Revolution*; Reprint edition; Harper One: New York, NY, USA, 1990; ISBN 978-0-06-250595-8.

4. Samuelson, P. *Economics: The Original 1948 Edition*, 1st ed.; McGraw-Hill Education: New York, NY, USA, 1948; ISBN 978-0-07-074741-8.

5. Schumpeter, J.A. *History of Economic Analysis*; Allen & Union: London, UK, 1954.

6. Dyson, B.; Greenham, T.; Ryan-Collins, J.; Werner, R. *Towards a Twenty-First Century Banking and Monetary System, Submision to the Independent Commission on Banking*; Independent Commission on Banking: London, UK, 2011.

7. Michel, A.; Hudon, M. Community currencies and sustainable development: A systematic review. *Ecol. Econ.* **2015**, *116*, 160.

8. Georgescu-Roegen, N. Energy and Economic Myths. *South Econ. J.* **1975**, *41*, 347–381.

9. Røpke, I. The early history of modern ecological economics. *Ecol. Econ.* **2004**, *50*, 293–314.

10. Soddy, F. *Wealth, Virtual Wealth and Debt the Solution of the Economic Paradox*; Omni: Seattle, WA, USA, 1930.

11. Daly, H. *For the Common Good: Redirecting the Economy toward Community, the Environment, and a Sustainable Future/Herman E. Daly and John B. Cobb, Jr.; with Contributions by Clifford W. Cobb.*, 2nd ed.; updated and expanded; Beacon Press: Boston, MA, USA, 1994; ISBN 978-0-8070-4705-7.

12. Humphrey, C. Barter and Economic Disintegration. *Man* **1985**, *20*, 48–72.

13. Ingham, G. Money is a Social Relation. *Rev. Soc. Econ.* **1996**, *54*, 507–529.

14. Ingham, G. *The Nature of Money*, 1st ed.; Polity: Cambridge, UK; Malden, MA, USA, 2004; ISBN 978-0-7456-0997-3.

15. Aglietta, M. *Money: 5000 Years of Debt and Power*; Verso: London, UK; New York, NY, USA, 2018; ISBN 978-1-78663-441-2.

16. Corner, E.J.H. The Durian Theory or the Origin of the Modern Tree. *Ann. Bot.* **1949**, *13*, 367–414.

17. Mellor, M. Gender and the Environment. In *The International Handbook of Environmental Sociology*; Redclift, M., Woodgate, G., Eds.; Edward Elgar: Cheltenham, UK; Northampton, MA, USA, 1997; ISBN 978-1-85898-405-6.

18. Plumwood, V. *Feminism and the Mastery of Nature/Val Plumwood*; Opening out; Routledge: London, UK; New York, NY, USA, 1993; ISBN 978-0-415-06809-3.

19. Warren, K. The power and the promise of ecological feminism. *Environ. Ethics* **1990**, *12*, 125.

20. Plato. *Timaeus and Critias*; Johansen, T.K., Ed.; Revised edition; Penguin Classics: London, UK, 2008; ISBN 978-0-14-045504-5.

21. Plato. *Phaedo*; Arc Manor: Kittanning, PA, USA, 2008; ISBN 978-1-60450-310-4.

22. Kheel, M. From Heroic to Holistic Ethics: The Ecofeminist Challenge. In *Ecofeminism: Women, Animals, Nature*, 1st Ed.; Gaard, G., Ed.; Temple University Press: Philadelphia, PA, USA, 1993.

23. Bordo, S. The Cartesian Masculinization of Thought. *Signs* **1986**, *11*, 439–456.

24. Polanyi, K. *The Great Transformation: The Political and Economic Origins of Our Time*, 2 ed.; Beacon Press: Boston, MA, USA, 2001; ISBN 978-0-8070-5643-1.

25. Li, H. A Cross-Cultural Critique of Ecofeminism. In *Ecofeminism: Women, Animals, Nature*, 1st ed.; Gaard, G., Ed.; Temple University Press: Philadelphia, PA, USA, 1993.

26. Donovan, J. Animal Rights and Feminist Theory. In *Ecofeminism: Women, Animals, Nature*, 1st ed.; Gaard, G., Ed.; Temple University Press: Philadelphia, PA, USA, 1993.

27. Kenny, A. *Anatomy of the Soul: Historical Essays in the Philosophy of Mind*, 1st ed.; Blackwell Publishers: Oxford, UK, 1973; ISBN 978-0-631-14960-6.

28. Beauvoir, S. *The Second Sex*, 1st ed.; Random House: New York, NY, USA, 1968; ISBN 978-0-307-27778-7.

29. Keen, S. *Debunking Economics—Revised and Expanded Edition: The Naked Emperor Dethroned?* 2 ed.; Zed Books: London, UK, 2011; ISBN 978-1-84813-992-3.

30. Graeber, D. *Debt: The First 5000 Years*; Upd Exp edition; Melville House: New York, NY, USA, 2014; ISBN 978-1-61219-419-6.

31. Linklater, A. *Owning the Earth: The Transforming History of Land Ownership*; Reprint edition; Bloomsbury: New York, NY, USA, 2015; ISBN 978-1-62040-291-7.

32. Locke, J. *Two Treatises of Government: With a Supplement, Patriarcha, by Robert Filmer*; Simon and Schuster: New York, NY, USA, 1947; ISBN 978-0-02-848500-3.

33. Brown, P. *Democracy in the Anthropocene*; Center for Humans & Nature: Chicago, IL, USA, 2013.

34. Shiva, V.; Mies, M. *Ecofeminism*; Zed Press: London, UK, 1993; ISBN 978-1-895686-28-9.

35. Norgaard, R.B. The case for methodological pluralism. *Ecol. Econ.* **1989**, *1*, 37–57.

36. Nadeau, R.L. The unfinished journey of ecological economics. *Ecol. Econ.* **2015**, *109*, 101–108.

37. Jevons, W.S. *The Theory of Political Economy*, 2nd ed.; Macmillan: London, UK, 1879.

38. Farley, J.; Schmitt, A.; Burke, M.; Farr, M. Extending market allocation to ecosystem services: Moral and practical implications on a full and unequal planet. *Ecol. Econ.* **2015**, *117*, 244–252.

39. Gowdy, J.; Erickson, J.D. The approach of ecological economics. *Camb. J. Econ.* **2005**, *29*, 207–222.

40. Gowdy, J. *Microeconomic Theory Old and New: A Student's Guide*; Stanford University Press: Redwood, CA, USA, 2009; ISBN 978-0-8047-7285-3.

41. Keynes, J.M. *The General Theory of Employment, Interest, and Money*; Palgrave Macmillan: London, UK, 1936; ISBN 978-1-987817-80-5.

42. Hicks, J.R. Keynes and the "Classics"; A Suggested Interpretation. *Econometrica* **1937**, *5*, 147.

43. Friedman, M. The Marshallian Demand Curve. *J. Political Econ.* **1949**, *57*, 463–495.

44. Krugman, P. IS-LMentary. In *The Conscience of a Liberal*; The New York Times: New York, NY, USA, 2011.

45. Foster, J.B.; York, R.; Clark, B. *The Ecological Rift: Capitalism's War on the Earth*; Monthly Review Press: New York, NY, USA, 2011; ISBN 978-1-58367-218-1.

46. Jochimsen, M.; Knobloch, U. Making the hidden visible: The importance of caring activities and their principles for any economy. *Ecol. Econ.* **1997**, *20*, 107–112.

47. Mellor, M. *Debt or Democracy: Public Money for Sustainability and Social Justice*; Pluto Press: London, UK, 2015; ISBN 978-0-7453-3554-4.

48. Ims, K.J.; Jakobsen, O.D.; Zsolnai, L. Product as process—Commodities in mechanic and organic ontology. *Ecol. Econ.* **2015**, *110*, 11–14.

49. Brown, P.G. Toward an economics of stewardship: The case of climate. *Ecol. Econ.* **1998**, *26*, 11–21.

50. Lawson, T. What is this 'school' called neoclassical economics? *Camb. J. Econ.* **2013**, *37*, 947–983.

51. Chapman, A. Barter as a Universal Mode of Exchange. *L'Homme* **1980**, *20*, 33–83.

52. Boulding, B. *Evolutionary Economics/Kenneth E. Boulding*; Sage publications: London, UK, 1981; ISBN 978-0-8039-1648-7.

53. Cirillo, R. Leon Walras' Theory of Money. *Am. J. Econ. Sociol.* **1986**, *45*, 215–221.

54. Ryan-Collins, J.; Greenham, T.; Werner, R.; Jackson, A. *Where Does Money Come From?: A Guide to the UK Monetary & Banking System*, 2nd ed.; New Economics Foundation: London, UK, 2012; ISBN 978-1-908506-23-8.

55. Varian, H. *Intermediate Microeconomics: A Modern Approach*, 9 ed.; W. W. Norton & Company: New York, NY, USA; London, UK, 2014; ISBN 978-0-393-12396-8.

56. Meikle, S. Aristotle on Money. *Phronesis* **1994**, *39*, 26–44.

57. Smith, A. *An Inquiry into the Nature and Causes of the Wealth of Nations/Adam Smith; General Editors R. H. Campbell and A. S. Skinner; Textual Editor W. B. Todd*; Glasgow Edition of the Works and Correspondence of Adam Smith; Clarendon Press: Oxford, UK, 1976; ISBN 978-0-19-828184-9.

58. Jackson, A.; Dyson, B. *Modernising Money: Why Our Monetary System Is Broken and How It Can Be Fixed*; Positive Money: London, UK, 2012; ISBN 978-0-9574448-0-5.

59. Mill, J.S. *Principles of Political Economy*; Penguin Books: London, UK, 1974; ISBN 978-0-14-040017-5.

60. Say, J.B. *A Treatise on Political Economy: Or The Production, Distribution, and Consumption of Wealth*; Augustus M Kelley Publishers: New York, NY, USA, 1852.

61. Samuelson, P.A. An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money. *J. Political Econ.* **1958**, *66*, 467–482.

62. Wheelan, C.; Malkiel, B.G. *Naked Economics: Undressing the Dismal Science*; Fully Revised and Updated edition; W. W. Norton & Company: New York, NY, USA, 2010; ISBN 978-0-393-33764-8.

63. Martin, F. *Money: The Unauthorized Biography—From Coinage to Cryptocurrencies*; Vintage: New York, NY, USA, 2015; ISBN 978-0-345-80355-9.

64. Zencey, E. *Fixing Locke: Civil Liberties on a Finite Planet*; White Paper; Empire State College: Saratoga Springs, NY, USA, 2009.

65. Mankiw, N.G. *Macroeconomics/N. Gregory Mankiw*, 8th ed.; Worth: New York, NY, USA, 2013; ISBN 978-1-4292-4002-4.

66. Krugman, P. Banking Mysticism. In *The Conscience of a Liberal*; The New York Times: New York, NY, USA, 2012.

67. Krugman, P. Minsky and Methodology (Wonkish). In *The Conscience of a Liberal*; The New York Times: New York, NY, USA, 2012. https://krugman.blogs.nytimes.com/2012/03/27/minksy-and-methodology-wonkish/

68. Mankiw, N.G. *Macroeconomics*, 6th ed.; Worth Publishers: New York, NY, USA, 2008; ISBN 978-1-4292-4002-4.

69. Fontana, G.; Sawyer, M. Full Reserve Banking: More 'Cranks' Than 'Brave Heretics.' *Camb. J. Econ.* **2016**, *40*, 1333–1350.

70. Mellor, M. *The Future of Money: From Financial Crisis to Public Resource*; Pluto Press: London, UK; New York, NY, USA, 2010; ISBN 978-0-7453-2995-6.

71. Dodd, N. *The Sociology of Money: Economics, Reason & Contemporary Society*, 1st ed.; Continuum Intl Pub Group: New York, NY, USA, 1994; ISBN 978-0-8264-0637-8.

72. Simmel, G. *The Philosophy of Money*, 3 ed.; Routledge: Abingdon, UK; New York, NY, USA, 2004; ISBN 978-0-415-61011-7.

73. Ritter, J.A. The Transition from Barter to Fiat Money. *Am. Econ. Rev.* **1995**, *85*, 134–149.

74. Hudson, M. The Archaeology of Money: Debt vs. Barter Theories of Money's Origins. In *Credit and State Theories of Money: The Contributions of A. Mitchell Innes*; Wray, L.R., Innes, A.M., Eds.; Edward Elgar Pub: Cheltenham, UK; Northampton, MA, USA, 2004; ISBN 978-1-84376-513-4.

75. Gardiner, G. The primacy of trade debts in the development of money. In *Credit and State Theories of Money: The Contributions of A. Mitchell Innes*; Wray, L.R., Ed.; Edward Elgar Pub: Cheltenham, UK ; Northampton, MA, USA, 2004 ISBN 978-1-84376-513-4.

76. Madrick, J. *Seven Bad Ideas: How Mainstream Economists Have Damaged America and the World*; Knopf Doubleday Publishing Group: London, UK, 2014; ISBN 978-0-307-95072-7.

77. Innes, A.M. What is money? *Bank. Law J.* **1913**, *30*, 151–168.

78. Innes, A.M. Credit theory of money. *Bank. Law J.* **1914**, *31*, 377–408.

79. Fayazmanesh, S. *Money and Exchange: Folktales and Reality*, 1 ed.; Routledge: London, UK, 2012; ISBN 978-0-415-65563-7.

80. Bjerg, O. How is Bitcoin Money? *Theory Cult. Soc.* **2016**, *33*, 53–72.

81. Knapp, G.F. *The State Theory of Money*; Macmillan & Co.: London, UK, 1924; ISBN 978-1-61427-496-4.

82. Harvey, D. *Seventeen Contradictions and the End of Capitalism*; Reprint edition; Oxford University Press: Oxford, UK, 2015; ISBN 978-0-19-023085-2.

83. Ruml, B. Taxes For Revenue Are Obsolete. *Am. Aff.* **1946**, *VIII*, 35–39.

84. Wray, L.R. *Modern Money Theory: A Primer on Macroeconomics for Sovereign Monetary Systems*, 2 ed.; Palgrave Macmillan: Basingstoke, UK; New York, NY, USA, 2015; ISBN 978-1-137-53990-8.

85. Gesell, S. *Establishing a Natural Economic Order Through Free-Land and Free-Money by Silvio Gesell: A Founder of the 1919 Bavarian Soviet Republic*; The Edwin Mellen Press: Lewiston, NY, USA, 1929; ISBN 978-0-7734-1574-4.

86. Hahn, F. *Money and Inflation*; Basil Blackwell Publisher: Oxford, UK, 1981.

87. Hayek, F.A. *Prices and Production*; Studies in Economics and Political Science, no. 107; GRoutledge & Sons, ltd.: London, UK, 1935.

88. McLeay, M.; Radia, A.; Thomas, R. *Money Creation in the Modern Economy*; Bank of England Quarterly Bulletin: London, UK, 2014.

89. Mellor, M. Money as a Public Resource for Development. *Development* **2012**, *55*, 45–53.

90. Ingham, G. The Emergence of Capitalist Credit Money. In *Credit and State Theories of Money: The Contributions of A. Mitchell Innes*; Wray, L.R., Innes, A.M., Eds.; Edward Elgar Pub: Cheltenham, UK; Northampton, MA, USA, 2004; ISBN 978-1-84376-513-4.

91. Graziani, A. The Theory of the Monetary Circuit. *Thames Pap. Political Econ.* **1989**, *1*, 1–26.

92. Minsky, H. *Stabilizing an Unstable Economy*, 1 ed.; McGraw-Hill Education: New York, NY, USA, 1986; ISBN 978-0-07-159299-4.

93. Lutz, F.A. *Roads to Freedom: Essasy in Honour of Friedrich A. von Hayek*; Streissler, E., Ed.; Augustus M. Kelley Publishers: New York, NY, USA, 1969.

94. Minsky, H. The Financial Instability Hypothesis: An Interpretation of Keynes and an Alternative to Standard Theory. *Challenge* **1977**, *20*, 20–27.

95. Mellor, M. Could the money system be the basis of a sufficiency economy? *Real-world Econ. Rev.* **2010**, *54*. 79–88.

96. Piketty, T. *Capital in the Twenty First Century*; Belknap Press: Cambridge, MA, USA, 2014; ISBN 978-0-674-43000-6.

97. Binswanger, M. Is there a growth imperative in capitalist economies? a circular flow perspective. *J. Post Keynes. Econ.* **2009**, *31*, 707–727.

98. Douthwaite, R. *The Ecology of Money*; UIT Cambridge Ltd.: Bristol, UK, 1999; ISBN 978-1-870098-81-6.

99. Norgaard, R.B. Ecosystem services: From eye-opening metaphor to complexity blinder. *Ecol. Econ.* **2010**, *69*, 1219–1227.

100. Gintis, H. Beyond Homo economicus: Evidence from experimental economics. *Ecol. Econ.* **2000**, *35*, 311–322.

101. Kallis, G.; Norgaard, R.B. Coevolutionary ecological economics. *Ecol. Econ.* **2010**, *69*, 690–699.

102. Røpke, I. FORUM: Prices are not worth much. *Ecol. Econ.* **1999**, *29*, 45–46.

103. Farley, J. Conservation Through the Economics Lens. *Environ. Manag.* **2010**, *45*, 26–38.

104. Rees, W.E. How should a parasite value its host? *Ecol. Econ.* **1998**, *25*, 49–52.

105. Ayres, R.U. Eco-thermodynamics: Economics and the second law. *Ecol. Econ.* **1998**, *26*, 189–209.

106. Spash, C. New foundations for ecological economics. *Ecol. Econ.* **2012**, *77*, 36.

107. Daly, H. Steady-State Economics versus Growthmania: A Critique of the Orthodox Conceptions of Growth, Wants, Scarcity, and Efficiency. *Policy Sci.* **1974**, *5*, 149–167.

108. Erickson, J.; Brown, P. *Balance: Club of Rome Magazine*, 2016, p. 8.

109. Nelson, J.A. Feminism, ecology and the philosophy of economics. *Ecol. Econ.* **1997**, *20*, 155–162.

110. Brennan, T. Economy for the Earth: The labour theory of value without the subject/object distinction. *Ecol. Econ.* **1997**, *20*, 175–185.

111. Mcmahon, M. From the ground up: Ecofeminism and ecological economics. *Ecol. Econ.* **1997**, *20*, 163–173.

112. Perkins, E. *Explorations: Feminist Ecological Economics*; Kuiper, E., Perkins, E., Eds.; Feminist Economics, 2005; Vol. 11, ISSN 1354-5701.

113. Brown, P.; Garver, G.; Helmuth, K.; Howell, R. *Right Relationship: Building a Whole Earth Economy*, 1 ed.; Berrett-Koehler Publishers: San Francisco, CA, USA, 2009; ISBN 978-1-57675-762-8.

114. Farley, J.; Burke, M.; Flomenhoft, G.; Kelly, B.; Murray, D.; Posner, S.; Putnam, M.; Scanlan, A.; Witham, A. Monetary and Fiscal Policies for a Finite Planet. *Sustainability* **2013**, *5*, 2802–2826.

115. Douai, A. Value Theory in Ecological Economics: The Contribution of a Political Economy of Wealth. *Environ. Values* **2009**, *18*, 257–284.

116. Farley, J.; Daly, H. *Ecological Economics*, 2nd ed.; Island Press: Washington, DC, USA, 2011.

117. Lawn, P. Facilitating the transition to a steady-state economy: Some macroeconomic fundamentals. *Ecol. Econ.* **2010**, *69*, 931–936.

118. Roma, A. Energy, money, and pollution. *Ecol. Econ.* **2006**, *56*, 534–545.

119. Singh, N.M. Payments for ecosystem services and the gift paradigm: Sharing the burden and joy of environmental care. *Ecol. Econ.* **2015**, *117*, 53–61.

120. Daly, H. Nationalize Money, Not Banks. Center for the Advancement of the Steady State Economy, USA, 2013. Available online: https://steadystate.org/nationalize-money-not-banks/ (accessed on 5 February 2019).

121. Keynes, J.M. *Treatise on Money: V 1: The Pure Theory of Money*; New Ed edition; Palgrave Macmillan: London, UK, 1930; ISBN 978-0-333-10724-9.

122. Dittmer, K. 100 percent reserve banking: A critical review of green perspectives. *Ecol. Econ.* **2015**, *109*, 9–16.

123. Galbraith, J.K. *Money: Whence It Came, Where It Went*; Houghton Mifflin: Boston, MA, USA, 1975; ISBN 978-0-7351-0070-1.

124. Rezai, A.; Stagl, S. Ecological macroeconomics: Introduction and review. *Ecol. Econ.* **2016**, *121*, 181–185.

125. Jackson, T.; Victor, P.A. Does credit create a 'growth imperative'? A quasi-stationary economy with interest-bearing debt. *Ecol. Econ.* **2015**, *120*, 32–48.

126. Miller, E. A Treatise on the Ecological Economics of Money; 2004; Available online: http://www.h4x.ca/TEEM/TreatiseEcologicalEconomicsMoneyEricMiller.pdf (accessed on 5 February 2019).

127. Fontana, G.; Sawyer, M. Towards post-Keynesian ecological macroeconomics. *Ecol. Econ.* **2016**, *121*, 186–195.

128. Cahen-Fourot, L.; Lavoie, M. Ecological monetary economics: A post-Keynesian critique. *Ecol. Econ.* **2016**, *126*, 163–168.

129. Wray, L.R.; Innes, A.M. *Credit and State Theories of Money: The Contributions of A. Mitchell Innes;* Edward Elgar Pub: Cheltenham, UK ; Northampton, MA, USA, 2004; ISBN 978-1-84376-513-4.

130. Odum, H.T. Energy, ecology, and economics. *Ambio* **1973**, *2*, *220–227*.

131. Gowdy, J.; Krall, L. The ultrasocial origin of the Anthropocene. *Ecol. Econ.* **2013**, *95*, 137–147.

132. Gendron, C. Beyond environmental and ecological economics: Proposal for an economic sociology of the environment. *Ecol. Econ.* **2014**, *105*, 240–253.

133. Spash, C.L. The shallow or the deep ecological economics movement? *Ecol. Econ.* **2013**, *93*, 351–362.

134. Mellor, M. Ecofeminist Political Economy: Integrating Feminist Economics and Ecological Economics. In *Explorations: Feminist Ecological Economics*; Perkins, E., Kuiper, E., Eds.; Feminist Economics, 2005; Vol. 11, pp. 107–150 ISSN 1354-5701.

135. Mellor, M. The politics of money and credit as a route to ecological sustainability and economic democracy. *Capital Nat. Soc.* **2005**, *16*, 45–60.

136. Dittmer, K. Communal Currencies. *Lat. Am. Perspect.* **2017**, *44*, 94–110.

137. Dittmer, K. Local currencies for purposive degrowth? A quality check of some proposals for changing money-as-usual. *J. Clean. Prod.* **2013**, *54*, 3.

138. Chick, V. *Dow On Money, Method and Keynes: Selected Essays*; Palgrave Macmillan: New York, NY, USA, 1992; ISBN 978-0-312-06815-8.

139. Mellor, M. Ecofeminist Political Economy and the Politics of Money. In *Eco-Sufficiency and Global Justice: Women Write Political Ecology*; Salleh, A., Ed.; Pluto Press: London, UK; New York, NY, USA, 2009 ISBN 978-0-7453-2863-8.

140. Dyson, B.; Hodgson, G. *Accounting for Sovereign Money: Why State-Issued Money Is Not "Debt";* Positive Money: London, UK, 2016.

Chapter 2: An Ecological Monetary Theory

Abstract: While money is critical to the modern world, ecological economics does not have a theory of money that is applicable to its theoretical framework and policy prescriptions. Accordingly, the field often defers to an orthodox conception of money that is historically inaccurate and ontologically inconsistent. The dualized nature of Western philosophy informs orthodoxy by defining money according its function as a medium of exchange. This conceptualization creates logical and historical problems that can be addressed by exploring an interdisciplinary literature that defines money according to its nature as a social relation expressed in a unit of account. This paper develops an ecological monetary theory that is simultaneously rooted in a socio-historical understanding of money's nature, and in an ontology of social and ecological embeddedness. Such a theory provides ecological economists, and others concerned with social and ecological equity, with a framework from which to address monetary systems and policy.

Keywords: monetary theory; ecological economics; ecofeminism; state theory; credit theory; nature of money

1. Introduction

Money is central to the functioning of modern economies with critical implications for how societies are organized. In orthodox economic theory, however, money is treated as

a neutral commodity medium of exchange that arose to make barter more efficient. This is a result of the dualism and atomism central to the economic model of barter exchange and manifests in both monetary theory and practice (Ament 2019, 9). From a theoretical perspective, Western philosophical structures divide reality into dualisms of hierarchically ordered opposites of superiority and inferiority (e.g. male/female, humans/nature). In barter conceptualizations of exchange, this dualism involves denying and inferiorizing the reproductive labor and natural resources inherent in commodities. Atomism emerges from dualism by reducing the complexity of economic exchanges to a summation of their attendant parts. Money is viewed in atomistic economic models as a commodity medium that facilitates equilibrium based upon the value commensurability involved in barter exchange (ibid).

In practice, orthodox monetary policy is, accordingly, enacted as though money were any other commodity, subject to the barter dynamics of supply and demand, and best created and allocated by utility-optimizing individuals. In modern economies, those 'individuals' are commercial banks who create the vast majority of money in circulation by generating interest-bearing loans in pursuit of profit maximization (Svartzman, Dron, and Espagne 2019). When the bulk of a nation's money supply exists as a function of commercial banks' profit motive, wealth is systematically transferred from borrowers to lenders and heavy strain is put on ecosystems to support the profitability of loans.

Ecological economics understands the problems of private money creation well (Soddy 1935; Daly 1994; Farley et al. 2013). As of this writing, however, ecological economics has not developed a comprehensive and internally-accepted theory of money. Where ecological economics does consider money, it does so largely in the barter-

commodity conception and thus imports the dualization and atomism attendant to that theory and the resultant social and ecological implications.

This paper develops an ecological monetary theory by using an interdisciplinary literature to explore three closely related questions that sociologist Geoffrey Ingham argues are critical to a theory of money: What is money? How does money get its value? How does money get into society? (Ingham 2004a, 10). In answering these questions, this paper addresses orthodox monetary theory by arguing that barter has never existed as a mode of economic organization and that a commodity medium is not the basis of money. It argues that these errors result from viewing money through its functions—what money does—and arise from the atomism inherent in the orthodox theory. Looking at money, instead, by way of its nature—what money is—reveals that money is, foundationally, an abstract unit of account for denominating credit and debt exchanges. Social relations are thus an inherent and critical component of money.

The difference between viewing money through its function versus through its nature manifests in how value is treated in monetary theory. While a functional, orthodox understanding of money as a medium leads to a biophysical conception, wherein economic value is the foundation of money, conceptualizing of money according to its nature leads to a social understanding, whereby money is the foundation of economic value (Aglietta 2018). Importantly, however, and often contradictorily, while money is a social relation, the economic value for which it forms the foundation is nevertheless biophysical. That is to say, money is a social abstraction that embodies a tangible claim on resources. This complication is a function of how the dualization and atomism of Western philosophy are reflected in orthodox monetary theory and practice.

An ecological monetary theory must, accordingly, address the philosophical structures of dualism by simultaneously considering money's nature as a social relation as well as the social and ecological relationships inherent in its production and use. This paper does so by outlining an ontology of embeddeddness that is rooted in both ecological economics and ecofeminism. It then explores monetary theory through an interdisciplinary lens of sociology, anthropology, philosophy, economics, and history. Finally, it links the ontological with the theoretical to provide a monetary theory that is rooted in socio-history and socio-ecological equity.

While excellent social and ecological studies of money exist, an ecological monetary theory must be capable of addressing both. In fact, the complexities and contradictions inherent in different theories of money are often a function of the perspective taken. The ecological monetary theory proposed herein is able to combine social and ecological perspectives of money by explicitly rooting its theory in an ontology of embeddedness. Such an approach is critical to providing ecological economists—and others concerned with social and ecological equity—with a framework from which to critique, discuss, and propose monetary systems. Such a framework has not been available before this writing.

2. Ontological and Ideological Foundations of a Theory

Western society is characterized by dualistic and atomistic philosophical structures. Dualism separates reality into "sharply demarcated sphere[s] of otherness" (Plumwood 1993, 41) and differs from dichotomy or difference by explicitly ordering opposites in a

hierarchical relationship of inferiority and superiority. Importantly, dualisms link superiors and inferiors by way of that relationship (Plumwood 1993, 41–47). Atomism reduces the complexity of interactions by analyzing systems as a function of their component parts and understands the whole by way of the summation, rather than the interaction, of those individual parts.

Dualism and atomism are ontologies of separateness, individualism, and prioritization. In orthodox economic theory, this dualism manifests as a model of barter commodity exchange in which the reproductive (often female) labor and ecosystem structure inherent in the production of commodities are denied. Similarly, atomism reduces the social interactions inherent in economic exchange to an asocial transaction between individual agents.

Money is a reflection of this dualistic philosophy in both theory and practice. In theory, money is a neutral commodity that atomistically represents the value commensurability between other commodities without respect to the social relations inherent in exchange. In practice, money is produced without consideration of the social relation inherent in that production, and exercises a claim without consideration of the ecological relation inherent the goods and services upon which it exercises that claim.

An ecological monetary theory that is capable of simultaneously addressing social and ecological issues must, thus, rest upon an ontology of embeddedness rather than separateness. This means addressing dualism by eliminating hierarchies of superiority and inferiority, and addressing atomism by considering the complex interactions between components of the whole. Regarding money as a unit of account for denominating credit and debt relationships, a theory must address the presuppositions behind how social

relations are expressed in the unit of account; by whom, for whom, and for what purposes credits are issued; and by whom, upon whom, and upon what debts are levied. An ontology of embeddedness perceives of these issues from the perspective of equity and interconnectedness between and amongst humans and the natural world, and informs both monetary theory and practice.

Ecological economics and ecofeminism each offer frameworks for such an ontology. The following sections explore the approaches of these two fields and how, together, they are capable of forming the basis of an ecological monetary theory.

2.1 Ecological Economics

Ecological economics' core premise is that the economy is an embedded subsystem of complex social and finite ecological systems that continually co-evolve (Daly 1977; Kallis and Norgaard 2010). As a transdisciplinary area of study, the movement has long advocated for methodological pluralism since diverse and interconnected systems make a core methodology difficult to define (Spash 1999, 425; Norgaard 1989). And while such an approach is certainly important, I argue that the "continual low-grade identity crisis" (Ricketts 2018) from which ecological economics has suffered is due, in part, to the potential for ontological divergence within pluralistic methodologies.

In many of the early writings in the field, ideology and ethical considerations were made explicit (Munda 1997). In order to avoid ontological divergence in an interdisciplinary exploration of monetary theory, this paper understands ecological economics through an ontology of embeddedness in which an objective biophysical reality exists independent of humans, ecological and social processes are interconnected

and co-evolutionary, and facts about social and environmental reality are inseparable from values (Spash 2012, 45).

These ontological presuppositions yield and interact with a core set of normative values and ideological beliefs that are inseparable from ecological economic analysis (Spash 2012, 44). These include, at the most broad, the explicit recognition of inter-species, inter-human, and inter-generational equity. Accordingly, distributional equity is a primary concern. Similarly, since economic processes consist entirely of ecological processes (Røpke 2004, 296), resource use is to be limited by the regenerative capacity and structural integrity of the ecosystem.

2.2 Ecofeminism

Ecofeminism is a transdisciplinary movement that integrates ecological concerns about human-dominated ecosystems with feminist concerns about gender subordination, arguing that a patriarchal economic system presupposes both (Mellor 2010, 23, 2009, 251). It integrates concerns about gender, race, class, and environmental oppression (Plumwood 1993, 1) by arguing that the dualistic structure of Western philosophy creates complex systems of oppression that crosscut and intersect specific systems of oppressions (Mellor 1997, 13; Gaard and Gruen 1993, 248).

Ecofeminists thus see the social and ecological "destructiveness of the Western socioeconomic system…as the result of the dualist nature of western society…that prioritize[s] one aspect of society through the denigration of its opposite" (Mellor 1997, 16). Two crucial dualisms engender that denigration: 1) the masculine is prioritized over the feminine, and 2) human society is prioritized over the natural world (ibid). By linking

the masculine with the human by way of their respective superiority, and conversely linking the feminine with the natural, dualistic philosophical structures prioritize productive and linear masculine labor that develops culture above reproductive and circular feminine labor that is natural and required daily.

Thus, ecofeminists argue that both liberal and socialist feminist arguments for equality within an implicitly dualized system fail to integrate how class, race, and the environment intersect with gender in destructive patriarchal economies. Mellor writes that while environmentally-minded economists aim to internalize the externalized ecological and social impacts of patriarchal economies, if the "market itself is seen as the source of the problem" (2009, 251), internalization simply embeds reproductive labor and natural resources into the destructive machinations of capitalist economies.

2.3 Ecological Economics and Ecofeminism as an Ontology of Embeddedess

Ecofeminism provides a useful framework for ecological economics due to the holistic approach it takes to wicked social, ecological, and economic problems. While ecological economics ultimately rests upon a framework of physical and social embeddedness, ecofeminism's critique of dualism provides a framework by which to link the physical with the social.

Making ontology explicit is important in theory development, as presuppositions are implicit in science whether made explicit or not (Spash 2012, 45). Failing to explicitly state an ontology with respect to monetary theory risks importing gendered, classist, racist, and extractive dualizations in which humans are superior to nature and linear, productive labor is superior to circular, reproductive labor. This can be seen in the

manner in which the dualistic structure of Western thought is manifest, though unacknowledged, in orthodox monetary theory (Ament 2019).

Incorporating social and environmental equity into monetary theory thus becomes an exercise in evaluating the ontological presuppositions inherent in the relationships between and amongst human society and nature. Specifically, this means addressing the unit of account and the systems of credits and debits that constitute money from an explicitly anti-dualistic perspective that yields an ethics of responsibility vis-à-vis our interactions with each other and the natural world.

The following outlines some basic tenets of an ontology of embeddedness upon which an ecological monetary theory may rest.

- Non-humans, unborn generations, and historically/currently marginalized groups have inherent value and moral standing.
- Economic activity must occur within the regenerative capacity of global, regional, and local ecosystems.
- Resources must be distributed equitably between and amongst humans of all races, classes, genders, and nationalities.
- Relationships of power—amongst humans and between humans and nature—must be explicitly considered.
- Economic efficiency is only an appropriate goal insofar as equitable distribution and regenerative scale have been adequately addressed.

3. Money in Orthodox Theory

3.1 Barter, Commodity, and Value Exchange

In orthodox economic theory, barter is the dominant mode of exchange throughout history and involves the asocial and final swapping of things of inherent value. Money arose, in this tradition, to address barter's double coincidence of wants problem. For Aristotle, this problem was temporal wherein purchases and sales were merged into one transaction (Meikle 1994, 26); for Adam Smith it was a spatial problem of specialized labor forces lacking what they need while holding an excess of what they create (Ament 2019, 5). According to orthodoxy, precious metal emerged from this dynamic as a universally-acceptable commodity to become money and allow exchange to function efficiently.

The idea that money is a technical tool to efficiently communicate underlying value dominates orthodoxy (Ritter 1995, 134). Classically, both Mill and Say argued that money represented the fundamental laws of value in which goods ultimately pay for goods (Mill 1974, 341; Say 1852, 178). In the neoclassical tradition, Samuelson wrote that "if we…peel off the obscuring layer of money…trade…largely boils down to barter" (Samuelson 1948, 49). Contemporarily, Mankiw writes that in all societies "some form of commodity money arises to facilitate exchange" (Mankiw 2013, 84). Even Marx argued that "the principal difficulty in the analysis of money is surmounted as soon as it is understood that the commodity is the origin of money" (1970, 64).

In this tradition money is treated as a "commodity which serves three purposes" (Barwell 2016, 12). It is a medium of exchange, a unit of account, and a store of value. As a commodity that facilitates barter exchange, however, the medium of exchange is the key function from which the others follow. The unit of account function solves the spatial

inconveniences of barter and the store of value function solves the temporal, yet both functions are realized by a commodity medium.

The barter-commodity formulation of money is explicit in the Walrasian equilibrium model in which money does not exist. Price, rather than money, serves as a value commensurability relation between two commodities and a third commodity of invariable value known as the numeraire (Walras 1954, 188; Cirillo 1986, 215). It is this commodity that serves as both money and a medium of exchange (Walras 1954, 189) to solve barter's inability to commensurably exchange value by providing a unit of account such that the value inherent in exchange may be stored.

It is critically important to note that in the commodity-medium-barter theory of money's origins, value is the foundation of money. Economic transactions involve exchanging value and money is simply a neutral technical medium that conveys information about the value inherent in the goods being exchanged. It is a tool without which exchange would suffer from the inconveniences of barter, but it has no other role, as value is the ultimate foundation of money.

3.2 Fiat Money and Commodity Policy

Modern money is fiat in that it is made legal tender by government decree and detached from any specific medium, created almost entirely by commercial banks when they generate loans. Yet, the idea that money is a commodity that represents value continues to dominate orthodox theory (Ingham 2004a, 7). Fiat money, in this tradition, evolved from commodity money as governments attempted to reduce the transaction costs of holding commodities like gold (Mankiw 2013, 84). Banks, accordingly, act as

intermediaries between savers who have cut back on spending, and investors who want to increase spending (Krugman 2012; Mankiw 2013). Thus even commercial fiat money is to be managed as a commodity since "it can be understood…by means of…supply and demand" (Ingham 2004a, 7) between savers and borrowers.

Thus, while modern money is not a commodity per se, orthodoxy nevertheless views it as a value intermediary that is rooted in a commodity and conceives of economic value as the ultimate base of the money supply. As Wheelan writes, "in theory, money is not even necessary" (2010, 228) and the machinations of the banking system are simply complex apparatuses for allocating value within an economy in much the same way a barter system might.

The idea that money is a commodity that arises to overcome the inconveniences of barter and that modern money is an evolution of that system is a reflection of the dualistic and atomistic presuppositions of our economic system (Ament 2019, 9). First, conceiving of value as foundational to money is dualistic in its treatment of the social and material inputs to the creation of that value. Conversely, the idea that economic actors ultimately exchange value for value—through either simple barter transactions or complex banking systems—is atomistic in its asocial focus on equilibrium (ibid, 10).

3.3 Money in Ecological Economics

Frederick Soddy laid some of the philosophical groundwork for ecological economics by articulating the contradiction between goods and services that are subject to entropy, and money as a non-entropic measure of those goods and services (Soddy 1930). Similarly, Daly writes that the "lack of symmetry in behavior between the…[value]…measured and

the measuring rod has serious consequences" (Daly 1994, 408). Each of these critiques is rooted in the idea that money is a device for measuring the value inherent in the goods and services.

Soddy and Daly also explicitly conceptualize of money as a commodity that arises from barter. Soddy wrote, reminiscent of Aristotle, that money replaced barter due to the fact that, with money, one agent gives up things of real value in exchange for money that can then be exchanged for other things of real value (Soddy 1935, 25–27). Daly writes that "barter…is the simplest and oldest method of exchange" and that "money…[is]…the standardization of one commodity as an instrument of exchange" (1994, 409, 414).

Given the importance that Soddy (1930, 163) and Daly (1994, 407) each placed on the study of money, it is surprising that ecological economics has not spent more time thinking about the subject (Douai 2009, 258). Where it does consider money, it follows Soddy and Daly by doing so largely in the orthodox barter-commodity-value conception.

Lawn writes that one is "happy to use money…because it allows you to overcome the inconvenience…of bartering" (2010, 932). Roma and Pirino use an equilibrium model "in which every good can be bartered against [every] other" to critique neoclassical substitutability assumptions vis-à-vis thermodynamic laws (2009, 2601). Jordan and Fortin write that pre-industrial economies utilized "bartering and local trade" (2002, 364) in arguing for ecologically sustainable economies.

Roma writes that "commodity money has been the economic standard for thousands of years" (2006, 544) in defending his model's use of a Walrasian energy numeraire. Nelson cites Marx's articulation of money as a "commodity albeit of a special kind" (2001, 502) to give monetary insight to ecological economists. Alexander and

Blum cite the "common example [of] the development of money as a medium" (2016, 243) to articulate the evolution of sub-systems. Russ argues that modern money has been decoupled from the value it once embodied and argues for a new money "based on knowledge and energy" (2016, 331).

Thus, while ecological economics, from its inception to present, is critical of the modern money system, its critique is nevertheless largely rooted in the orthodox idea that money is a commodity medium that overcomes the inefficiencies of exchanging value with barter. The following section addresses this orthodoxy.

4. What is Money?

4.1 Money's Nature vs. Money's Function

In the commodity-medium tradition discussed above, money is defined by its ability to function as a medium of exchange, a store of value, and a unit of account. While these three functions are important for a particular money form, viewing money by way of its form blurs the distinction between function and nature and confuses what money does with what money is by implying that nature is embodied in function. Following this implication, Ingham asks the following: "Do all the functions of money have to be performed before 'moneyness' is established? If not, which are the definitive functions?" (Ingham 2004a, 5).

Orthodoxy maintains that money's definitive function is that of a medium of exchange, under which its functionality as a unit of account and store of value are subsumed (Ingham 2004a, 6). Three logical and historical difficulties, however, are

inherent in conflating what a particular money form does with that form's money-ness or embodied nature.

- Logically, a unit of account cannot arise from a medium of exchange.
- Historically, there is no evidence of economies based on barter.
- Exchange is neither asocial nor final; power and temporality are fundamental.

The following sections consider money's nature as something separate from its functions—neither embodied within, nor embodying, those functions—and allow us to address these difficulties. Money is more broad than a medium of exchange, and its nature is in something deeper than its functions. Ingham argues that money's nature is embodied in an "abstract money of account [that] is logically anterior to money's forms and functions" (Ingham 2004a, 6). In other words, money as a unit of account confers money's nature, under which the functions medium of exchange and store of value are subsumed as advantageous attributes of a given money form (Ingham 2004a, 6; Muzio and Robbins 2017, 58).

This paper defines money according to this nature. Money is a sovereign unit of account for denominating credits that are capable of settling all debts public and private. The following explores how the Credit and State Theories of money work together to uphold that definition and address the difficulties of the orthodox conception.

4.2 The Credit Theory of Money

Alfred Mitchell Innes argued, in two definitive publications on monetary theory, that "money…is credit and nothing but credit" (1913, 402). This section explores how Credit

Theory addresses the problems attendant to the orthodox conception of money, and elucidates that credit is the foundation of money and exchange.

4.2.1 Difficulty One: A Unit of Account as a Logical Solution to the Exchange Rate Problem

Innes' broad argument was that the commodity and barter theories of money as a medium of exchange reconstructed "civilisation's early economic history along individualistic lines" (Hudson 2004, 116). Citing archaeological and numismatic studies of the composition and value of coins, he argued that since the metallic content was extraordinarily varied and the value and weight were always incongruent, coins were representative tokens of a unit of account rather than a commodity medium of exchange (1913, 379–82). Regarding ancient Greece, Europe, China, the Americas, New Zealand, the Islamic world, and South Africa, the story is the same: all coins were tokens of arbitrary value, divorced from and incongruent with their commodity content (ibid, 382).

This arbitrary value reflects the fact that money's form as coin or other tokens simply provides functionality to money's nature as an abstract unit of account. As Grierson writes, "behind the phenomenon of coin there is the phenomenon of money" (1977, 33). Money as an abstract unit of account predates coin money as an exchange media by thousands of years (Ryan-Collins et al. 2012, 34). In fact, a money of account must exist before exchange with a medium can take place due to the near impossibility of a stable exchange rate emerging from subjective preferences (Ingham 2004b, 181).

The neoclassical approach to this problem was the numeraire commodity that served as a medium of invariable value to which two commodities were compared

(Cirillo 1986, 215; Walras 1954, 188–89). This, however, implies that a numeraire can be "at once a commodity itself and a special representor of commodities" (Ament 2019, 7) leading to the "obvious absurdity" of the numeraire being denominated in itself (Innes 1913, 378). It also assumes that a unit of account will spontaneously arise from that commodity, something Aglietta (2018, 19–22) and Ingham (2004a, 25) each argue would require a pre-determined exchange rate that would render such emergence redundant.

Simmel addressed this logical trap by arguing that measures need not exhibit the same quality as the objects they measure (2004, 131–32). For Simmel, the unit of account in any monetary standard must be an abstract measurement, relative to which two objects being measured are made proportional (ibid, 146). Accordingly, the logical difficulties attendant to viewing money through one of its functions as a medium of exchange disappear when "money's nature is conferred by money of account" (Ingham 2004a, 71).

This becomes more clear when we consider that specific money forms are multiple and heterogeneous, and dissociated from money's nature. That is to say, money forms such as coins and bills provide function to, and represent, money but are not money themselves (Martin 2015, 14). An abstract money of account for clearing credit accounts homogenizes that heterogeneity—and the heterogeneity of the relations inherent in money—in a way that a commodity cannot (ibid). This will be explored now.

4.2.2 Difficulty Two: Debt and Credit as a Historically-Accurate Solution to the Barter Problem

Beyond solving the exchange rate difficulties of viewing money through its function as a medium, viewing money through its nature as a unit of account is crucial for two reasons

related to debt: seasonality and production stages. Since most products involved in exchange are seasonal by nature, direct unilateral exchange is often impossible. Similarly, most goods involve adding value to raw materials in sequential production stages (Gardiner 2004, 130). Accordingly, merchants frequently have nothing to exchange for the raw materials they will transform into finished products.

Systems of debt and credit, both in preparation for the productive season and for access to the raw inputs of value-added production, are thus vital to exchange. All societies, from Bronze Age Mesopotamia to ancient Egypt and China, have conducted exchange by running up debts balances denominated in an abstract unit of account to bridge the gap between planting and harvesting, and raw materials and finished products (Hudson 2004, 117). And since debt is itself abstract, the unit of account used for tracking debts must also be abstract. Such systems of debt are, in fact, so foundational to society that they predate writing and literacy (Graeber 2014, 220; Martin 2015, 43).

Given this conception of debt underpinning historical market exchange, and the logical difficulties of barter systems generalizing a rate of exchange, anthropologist Caroline Humphrey argues that "no example of a barter economy…has ever existed, let alone the emergence from it of money" (Humphrey 1985). Graeber (2014), Ingham (2004a), Aglietta (2018), and Hudson (2004) all agree: debt, rather than barter, and a unit of account, rather than a medium of exchange, form the basis of money.

But debt is not money and is not synonymous with credit. Credit lies opposite debt and is a claim while a debt is an obligation. Possessors of credits are owed something; either goods or services, the debts of others, or, since creditors are often debtors themselves, the elimination of their own debts (Innes 1913, 303; Bjerg 2016, 64).

Accordingly, all money is credit; but not all credit is money. Credit only exists as money if it is capable of extinguishing any debt incurred by the issuer (Ingham 2004a, 12). For this to be possible, debts and credits must first be transferable (ibid) and depersonalized (ibid, 115).

Money thus becomes money when "a bilateral debt [can] be used in the settlement of a third party debt" (Ingham 2004b, 200) and exists as "the transferability of debt to the point where it could serve as a general impersonal means of payment" (ibid, 199). Accordingly, money can be thought of as "a bill of exchange from which the drawee is lacking" (Simmel 2004, 177). This is why Gardiner argues that the monetization of trade credit is the most important invention in the history of commerce (2004, 133).

4.2.3 Difficulty Three: Power as Central to Credit/Debt

While barter transactions are asocial and final, assuming equality amongst participants and completeness between transactions, as we have seen, money is constituted by relationships of credit and debt. These relationships are necessarily relationships of owing and being owed and, at the macro-level, exist in perpetuity. Money is thus a social relationship of power and inequality between debtors and creditors (Ingham 2004a, 91; Henry 2004, 79).

Simmel argues that exchanges that use money are structurally different from barter exchanges in that they are constituted by this social relation (Simmel 2004, 177). Since the historical and anthropological evidence suggest that barter has never existed as an economic mode (Graeber 2014, 28), it follows that money's nature as expressed in this paper must be structurally different from its function as expressed in the orthodox

account. Money must, instead of a neutral medium of exchange that facilitates barter, be thought of as a social relation that embodies the spatio-temporality of debt and the power inherent in credit.

4.2.4 Credit: The Foundation of Money and Exchange

Contrary to the orthodox conception of a commodity medium arising to address the inefficiencies of asocial barter, the prior sections have shown that a unit of account arises to account for credit/debt relationships of power. Together they make the logically- and historically-accurate claim that social systems of credit are foundational to money and exchange. While Adam Smith argued that the division of labor gave rise to commodity money in response to merchants' spatial asymmetries, the division of labor, in fact, required systems of transferable credit denominated in an abstract measure. And while Aristotle argued that barter merged purchases and sales, in fact, systems of credit/debt allowed these transactions to be separated in time.

Innes argued that Smith's account of commodity money in Scottish and Newfoundland villages, where nails and fish were used for purchasing food and supplies, respectively, was flawed. What Smith believed to be bilateral exchanges of commodities were in fact systems of credits and debts denominated in the British unit of account . Fish and nails were simply token money forms for expressing the tally of shillings and pence on a vendor's books (1913, 378). The same regards other popular commodity money forms such as cacao, cowrie shells, or cigarettes: the commodity medium is only a token of the unit of account used to denominate systems of credit and debt. Thus when Innes argued that "there is no such thing as a medium of exchange" (1914, 168), he meant that

all mediums of exchange are simply exchangeable money forms of money's underlying nature.

For Innes, then, commodities are exchanged for neither commodities, as in the orthodox theory, nor for any particular money form. Commodities are exchanged for credits that can extinguish accumulated debts (ibid). As he wrote: "the object of commerce is the acquisition of credits" (ibid). Markets are simply mechanisms for acquiring credits and extinguishing debts and can be thought of as accounting clearinghouses. This strongly opposes the conventional wisdom that markets are a place for exchanging the value inherent in goods and services.

Considerable trust is involved in these transactions that is not required for bilateral commodity exchange. A seller must trust that the credit she receives in exchange for a commodity will be redeemable, not by the proximal, but by the ultimate issuer of the credit. Money is thus dependent upon the legal systems that both support the transferability of debts and credits and that enforce the networks of trust such systems require (Gardiner 2004, 130). Referring to the definition of money as a unit of account for denominating credits that are capable of settling debts, a central question arises: Who or what is capable of determining the unit of account and enforcing the laws money requires? It is here that we find the Credit Theory's natural corollary: State Theory.

4.3 The State Theory of Money

Frederick Knapp argued in his State Theory of Money that "money is a creature of law…[and therefore exists]…not in the material of the pieces, but in the legal ordinances

which regulate their use" (1924, 1–2). This section uses an interdisciplinary literature to explore the role of the State in upholding systems of credit.

4.3.1 Primordial Debt and Wergild

While the trade debt discussed above is central to monetary theory, money has in fact evolved from three traditions of debt: primordial debts related to social existence, wergild debts to compensate for injury, and administrative debts created by States (Hudson 2004, 99). Thus, while this paper's definition of money is approximately five thousand years old, its foundations lie much earlier.

Bruno Théret writes of birth as the "original debt incurred by all men" (Théret 1999, 60). It is the primordial debt that all living humans owe to those who laid the foundation for our existence and to the society that secures that existence (Ingham 2004a, 90). Systems of wergild payments, where victims of violence were compensated for their injury, emerged from this context as punishment for transgressions against this primordial social obligation (Ingham 2004a, 92). The etymological evidence that the word for debt in nearly all languages is synonymous with 'sin' and 'guilt' (Hudson 2004, 102) suggests that wergild evolved to mediate between the contemporary and primordial. These 'worth payments' were levied based upon the injured party's social role (Grierson 1977, 33) and imply that, long before it is a market, society is a moral community that exists, not by barter, but by reverence to an existential social obligation (Ingham 2004a, 93).

Primordial debts and wergild systems do not constitute money, however, as egalitarian communities have no use for comparing debts (Henry 2004, 79). But as egalitarian order gave way to specialization and social hierarchy, and the value of

individual roles diverged, “wergild codified elements of social structure into a hierarchy of value, and thereby transformed them into elementary moneys of account” (Ingham 2004a, 93). In ancient Egypt, for example, control of the Nile for irrigation, coupled with the agricultural surpluses that such control allowed, led to specialization and inequality amongst previously egalitarian agriculturalists (Henry 2004, 84). Over centuries, this specialization led to a new social organization in which the primordial life debts were converted into tax debts that were levied upon agricultural surplus and redistributed to the ruling class’ bureaucracy (Henry 2004, 85, 90–91).

With the development of numeracy, the social obligation was transformed into an abstract unit of account for measuring tax debts and equivalencies between commodities (Ingham 2004a, 91). As discussed above, such an abstract unit is capable of homogenizing otherwise heterogeneous debts and factoring them out of interpersonal relations (Maucourant 1993). In this manner, primordial social debts were broken into systems of fines, fees, and taxes subject to individual expiation (Graeber 2014, 60–61).

4.3.2 The State’s Role

It was the State that codified and homogenized wergild and primordial debts into moneys of account (Théret 1999, 61). In the transition from reciprocity and hospitality that once governed distribution, to the hierarchical taxation and redistribution of surplus, the State detached the economy from society and codified money (Ingham 2004a, 90). Such bureaucracy required an elaborate accounting system upheld by a unit of account that the sovereign specified arbitrarily, much like it does with weights and measures (Huber 2014, 50; Henry 2004, 92).

Hierarchical societies are thus fundamentally monetary societies held together by arbitrarily-denominated networks of credit and debt. As such, money is underpinned and constituted by sovereignty and cannot be understood without reference to an authority (Ingham 2004a, 12). Knapp argued that to consider money without the authority of the State was absurd. I argue that the State is integral in establishing the unit of account and upholding the system of credits that constitute money for four reasons subsumed under two main categories: political and economic.

4.3.2.1 Political

First, as discussed, primordial debt theorists argue that social debt constitutes "one of the fundamental…bonds between the individual and society (Ingham 2004a, 90). The legitimacy of the State to determine the arbitrary unit of account was, and is, ultimately linked to its guardianship over the primordial debt that all individuals have to one another and to those who came before them (Graeber 2014, 56). In this role, the State is entrusted with mediating the social debt and, through the tax apparatus, transfers belief into currency (Théret 1999, 61).

Second, as we have seen, money is fundamentally a creature of the law (Dodd 1994, 27). Just as a division of labor requires systems of debt and credit, systems of debt and credit require legal enforcement. This is especially true given that credits are drawn upon unknown initial issuers and can be redeemed by any individual bearer. Such transferability is the result of years of legal development that allowed credits to be assigned to others without consent of the original issuing parties (Gardiner 2004, 132; Ingham 2004a, 97).

4.3.2.2 Economic

Third, while money is a credit capable of settling a debt, the largest and most important portion of debts are taxes owed to the State (Ingham 2004a, 47; Hudson 2004, 117). Accordingly, Knapp argued that it was "not the issue, but the acceptation [in payment of taxes] which is decisive" in establishing money (Knapp 1924, 95). For five thousand years, States have created money by spending credits denominated in the unit of account it will accept in payment of the tax debts it levies. As Ingham notes, "the State issue and reacceptance of tax debt is the most important development in the development of money" (Ingham 2004b, 178).

Fourth, and closely related, the State is, and has always been, the single largest purchaser of goods and services in the economy (Dodd 1994, 30; Ingham 2004a, 84; Innes 1914, 168). This affords the State the power to determine the money of account with which it will issue credits in payment of those goods and services. While Weber argues that "it might be possible to establish a private monetary network" (Dodd 1994, 29–31), the State's unrivaled purchasing power nevertheless guarantees its role as arbiter of the unit of account.

Since the State is simultaneously the largest economic entity and the only entity capable of legally levying taxes, it emerges as the de facto arbiter of the unit of account. When the State issues credits in exchange for goods and services, it promises that those credits can eliminate tax debts. And when it accepts those credits in payment of taxes, it eliminates the debt it holds itself as a unit of tax relief to the bearer of the credit. This spend-and-tax cycle is the "logical [precondition] for money's existence (Ingham 2004a,

49). As Ingham (2004a, 84) and Wray (2004, 246) both argue, this confers upon States great power in determining, not only money's functional value as expiator of tax debts, but its substantive value given the economic direction that the State determines.

5. Ecological Monetary Theory

As I have argued elsewhere, an ecological monetary theory must be simultaneously rooted in an understanding of money's socio-history and in a non-dualized ontological approach to human-human and human-natural relations (Ament 2019). Failing on the former risks importing a flawed understanding of money, while failing on the latter risks applying theory in a socially and/or ecologically inequitable manner. Such an ecological monetary theory can act as a filter through which we may judge past, current, and proposed monetary systems vis-à-vis their money-ness and their alignment with social and ecological equity.

In framing an ecological monetary theory, this paper has explored the three questions that a theory of money must satisfactorily answer: What is Money? How does money get its value? How does money get into society? This section answers those questions in the context of Section 4 and outlines an ecological monetary theory by integrating those answers with the embedded ontology outlined in Section 2.

5.1 Three Questions a Theory of Money Must Answer

5.1.1 What is money?

Money is not a neutral commodity medium that emerged from barter, as is implied when viewing money according its functions. Money is a sovereign unit of account for

denominating credits that are capable of settling all debts public and private. Viewing money this way allows us to define money according to its nature as a unit of account under which its functions as a store of value and medium of exchange are subsumed as advantageous, though not necessary, attributes.

Orthodoxy implies that asocial agents choose to accept a money form given its ability to store value or serve as a medium. Considering this choice from the perspective of money's nature, it is the State's taxation capacity, purchasing power, role as legal arbiter, and guardianship of social debt that requires that agents accept credits of account with which they can pay tax debts. Since systems of credit and debt are social relations, and the unit of account is decreed by the State as guardian of the social debt, money is a social relation mediated by the State. This dynamic can be seen when currencies lose their ability to store value and trade continues with credit-based systems of exchange denominated in the State's unit of account (Fayazmanesh 2012, 87). Thus, while they are different, it is impossible to separate the State and Credit theories, as each is dependent upon the other throughout history and crucial in defining money's nature.

The credits that a unit of account denominates are fundamentally claims upon the goods and services that constitute the social product. Money is, thus, also a social claim on resources. Credits, however, are abstract claims on resources, not the resources themselves. Similarly, a unit of account is an abstract measure of value, not value itself. Money is therefore not biophysical, and, as an abstract denomination of abstract credits, cannot be.

It is only through the social organization that money is able to store and transport value, abstracted not only from any sort of materiality, but also from the spatio-

temporality of a particular transaction (Ingham 2004a, 72). Money's constitution as a social claim on resources is, thus, presupposed by the power relations inherent in the social organization.

5.1.2 How does money get its value?

Money's value consists of its ability to cancel a debt (Ingham 2004a, 12). As a unit of account for denominating credits that are capable such cancellation, money's ultimate value is a function of the nature of the relationship between users of money and the entity that determines the unit of account, issues credit, and levies debts. Since credit and debt relationships are relationships of inequality, and since the unit of account is decreed by the same entity that levies debts, the nature of the money relationship is one of power.

As guarantor of the social debt, the State mediates the social relation by decreeing the unit of account and levying tax debts. This gives the State tremendous power in controlling what has value in society through its ability to issue credits for the economic mix it desires, in the money of account it determines and that it demands in payment of taxes. And while only the State may determine the unit of account and levy taxes, the prerogative of credit creation has been shared throughout history with commercial interests (Graeber 2014, 213–14). This dual nature of money, in which private entities are capable of creating credits that become State money when accepted in payment of tax debts, is incredibly important when considering how money gets its value.

As discussed above, an orthodox understanding of money as a medium of exchange implies that value is the foundation of money. Since value is not inherent in money's nature as an abstract denomination of credit, however, value cannot be the

foundation of money. The foundation of money is to be found, rather, in the socio-political conflict over what is valuable and how much value that which is valuable has. In other words, money is a result of the conflict between States, citizens, and commercial interests over the direction of the socio-economy (Ingham 2004a, 66,80). Accordingly, and following Aglietta (2018), this paper argues that money is the foundation of what has value in an economy.

Specifically, the foundation of value is to be found in the system of credits and tax debts—and the unit of account in which they are both denominated—that constitutes money. What is valuable in society, and how money gets its value, is thus a function of the normative order of society that determines by whom, for whom, and for what purposes credits are created; by whom, upon whom, and upon what taxes are levied; and how the unit of account quantitatively expresses socio-natural relations.

Rather than acting as a positive lubricator of exchange, money reflects the ontological presuppositions of society and normatively drives what is valuable. The distinction between value laying the foundation of money and money laying the foundation of value has radical implications for how money gets into, circulates, and leaves a society, especially vis-à-vis socio-ecological equity. This will be explored now.

5.1.3 How does money get into society?

Knapp wrote that it was not the issuance but the "acceptation…which is decisive" (Knapp 1924, 95) in conferring money-ness upon a particular money form. While this is certainly true regarding money's nature and ultimate value, the manner in which money

is issued is of vital importance for the social and ecological issues with which this paper is concerned.

As discussed above, society's ontological presuppositions lay the foundation of money, and money lays the foundation of value. Within a dualized and atomistic socio-economic model, what is ascribed value is, thus, ultimately a function of a philosophy in which humans are superior to nature and productive labor is superior to reproductive labor (Plumwood 1993). Accordingly, money gets into society as a result of a monetary system that determines a unit of account, issues credits, and levies tax debts based upon a dualized conception of what is valuable. Since modern monetary systems reflect the conflict between State and commercial interests, this occurs in two ways.

States create money by issuing credits to purchase the economic mix they desire. That mix is a function of a modern economic system that prioritizes growth over social or ecological equity (Ament 2019, 4). Commercial interests create money by issuing credits in the form of interest-bearing loans. The profitability of these loans prioritizes "socially- and ecologically-harmful activities…over sufficiency activities" (ibid, 10).

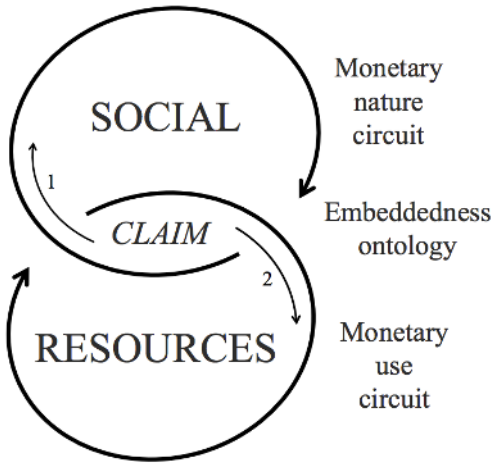
The unit of account that denominates both State and commercial credits as well as the tax debts that ultimately give them value each express a fundamentally dualized social and natural relation. Money itself is thus a dualism that embodies the tension inherent in being a socially-constructed store of abstract value whose production and distribution is privately appropriable.

As Chick writes, "money confers on those with authority to issue new money the power to pre-empt [social and ecological] resources" (1992, 141). Thus, while money is a social relation and is not biophysical, the manner in which money gets into and circulates

within society has powerful social and biophysical implications. An ecological monetary theory must be capable of addressing this contradiction in a manner consistent with the answers to the questions What is Money? and How does money get its value?

5.2 A Mediated Circuit Theory

There is tension in the fact that money is social yet is created by individuals, is abstract yet commands the biophysical, and manifests as forms by which it is not defined. Such tension is inherent to viewing money from a strictly social or biophysical point of view, or when avoiding ontological presuppositions. This paper proposes a two-tiered ecological monetary theory in which this tension is mediated through an ontology of embeddedness (Figure 1).



(Figure 1)

While Figure 1 explicitly separates the social from the biophysical, the two are intricately linked through the fact that money is a social claim on resources. This is important: while historical analysis articulates money's nature as a social claim, that

history is an unjust and extractive one. Ecological monetary theory must, therefore, define money according to its history while considering its claim from the perspective of socio-ecological equity. A two-tiered theoretical approach brings the social alongside the biophysical in a manner rarely seen in the literature. While sociology, anthropology, philosophy, and history provide excellent framing for money's nature as a social relation, they largely lack a comprehensive exploration of the biophysical impacts that such a social relation entails. And while examples exist that outline the biophysical impacts of our monetary system, they largely fail in their conception of money's nature, either rooting it in the biophysical or removing it from society.

The monetary theory proposed herein addresses these shortcomings. The framework presented in Figure 1 can be read from top to bottom as follows: Money is a social claim on resources. The 'monetary nature' circuit regards money's nature as explored in Sections 4 and 5.1.1. This circuit is concerned with money's specific money-ness as an abstract social relation. The 'monetary use' circuit regards money's ability to claim resources. This circuit is concerned with the tangible biophysical relation inherent to a particular money form.

The 'claim' represents the overlap between the two circuits and works to mediate the manner in which the social relation claims resources. Drawing from Ingham who calls for an "ontology of money" (1996, 509), this mediation is rooted in the ontology outlined in Section 2.3 and operates in two important ways.

- The social claim, arrow 1, is rooted in a non-dualized conceptual framework that eliminates the inferiorization of gender, class, and race. It considers who benefits

from money's production (including the unit of account, and systems of credits and debts) and the social direction in which the money issuer drives the economy.

- The resource claim, arrow 2, is rooted a non-dualized conceptual framework that eliminates the inferiorization of nature. It considers the monetary relation to the environment and the environmental direction in which the money issuer drives the economy.

5.3 Testing Ecological Monetary Theory

Ecological monetary theory can be seen as a filter through which a monetary system's desirability may be tested vis-à-vis its money-ness, and social and environmental equity. While money's acceptance in expiation of tax debts is critical to money's "essense" (Dodd 1994, 28), since a money's issuer influences what gets done in society (Dittmer 2015, 12; Ingham 2004a, 84), money under "law"—the particular monetary constitution—is a critical reflection of that society's social and environmental disposition. Huber makes this essence/legal distinction clear when he argues that modern money is money in essence in that it is denominated in a sovereign unit of account, but, having acquiesced the legal prerogative to issue money, States have lost the benefit of first use that comes with such issuance (Huber 2014, 50).

The two-tiered ecological monetary theory presented herein provides a framework for considering this contradictory dynamic. Importantly, it allows for the consideration of three questions, derivative of the initial questions this paper asked, when considering monetary policy.

1. Is it money? (Monetary nature circuit)

2. Is its value a function of an equitable socio-ecological power structure? (Claim mediation)
3. Is it issued into and removed from society by means of socio-ecological equity? (Monetary use circuit)

Testing the modern monetary system through the two-tiered filter reveals that it is indeed money by nature. Its issuance by private entities in the interest of profit, however, engenders social inequity as money is transferred from borrowers to lenders and necessitates extraction to earn credits and eliminate debts (Ament 2019, 10). Further, a restrictive value boundary is placed around profitable activities. It thus fails as a desirable monetary system.

Conversely, while many local currencies are issued and circulate by means of social and ecological equity, the unit of account in which they are denominated is often a commodity rather than an abstraction (Russ 2016; Roma 2006; Ingham 2004a, 183). Further, complementary currencies are rarely able to expiate tax debts. Complementary currencies, thus, often fail the money-ness test.

These examples display how ecological monetary theory can serve as a tool for testing monetary theories, systems, and proposals according to their money-ness and desirability. This includes considering Modern Money Theory (Wray 2015), Full-Reserve Banking (Farley et al. 2013), and proposals for sovereign money (Dyson et al. 2011), among others. The theory can also serve as a frame for designing alternative monetary systems at both local and national scale. Similarly, Figure 1 and the questions above may be used to assess monetary research such as Jackson and Victor's consideration of the

growth imperative (2015) and Campiglio's consideration of the role of banking in an energy transition (2016).

6. Conclusion

This paper has made a somewhat simple argument with novel and radical implications for monetary policy. Viewing money through its function as a medium of exchange implies that the value inherent in exchange is the foundation of money. Viewing money through its nature as a unit of account implies that money is a social relation of debt and power that informs what is valued in an economy. While the former, orthodox view yields a monetary system whose goal is to efficiently allocate finite stocks of value-based money to yield social optimality, the latter implies that a society's ontological presuppositions determine how we spend and destroy money. The irony is that the latter is true regardless of how money is conceived in theory, i.e. while orthodoxy conceives of money as a medium, the system it informs is nevertheless a function of its ontological presuppositions.

The idea that value is the foundation of money informs the misconception that in order to address social and ecological issues, we must assign those things value and money will follow, e.g. monetizing household labor or payments for ecosystem services. Understanding that money is the foundation of value reveals that the leverage point for ascribing value to inferiorized and non-moneyed spheres is in the ontological presuppositions that lie behind the unit of account and the socio-ecological relation of credit-debt that constitutes money. Specifically the leverage point is in how, to whom,

and for what credits are issued; upon whom and what tax debts are levied; and how social relations are expressed in the sovereign unit of account.

An ecological monetary theory must, thus, be rooted in a non-dualized holistic normative order that yields a social understanding of money and a monetary system that gives value to gender, class, race, and the natural world. The two-tiered monetary theory proposed herein does this by resting upon four pillars subsumed under the ontological and the monetary. The ontological is rooted in ecological economics' pre-analytical vision and ecofeminism's non-dualized philosophy. The monetary is rooted in the Credit and State Theories and how their crucial interplay defines money according to its nature.

The following is a non-exhaustive list of the tenets of an ecological monetary theory.

- Money is a social relation that establishes a claim upon resources; its lifecycle should be consistent with social and ecological equity.
- Since the State determines the unit of account and levies the taxes that drive money, it should determine, and benefit from, how credits are issued.
- Humans and nature are part of a single co-evolutionary system. Money should be issued and accepted in a manner that enhances that relationship.
- Circular and reproductive activities should be included in the monetary space in order that their undertaking may be able to eliminate debts.

As has been shown, money has a pre-analytical and pre-distributive function; at the point of its production, money reflects the ontological presuppositions of society. As Ingham writes, economic analysis may only proceed once money has been produced

(Ingham 2004a, 198). The theory proposed herein provides a tool with which those concerned with social and ecological equity may consider how a system produces money in order to proceed with subsequent economic analysis.

Funding: This research was supported by the Economics for the Anthropocene project. It was funded by The Social Science and Humanities Research Council of Canada; Gund Institute for Environment at The University of Vermont; and The Rubenstein School of Environment and Natural Resources at The University of Vermont.

Acknowledgments: I would like to thank Joshua Farley and Caitlin Morgan for their insightful feedback on early drafts of this paper. I would like to thank Ole Bjerg, Ben Dyson, Joseph Huber, Mary Mellor, Richard Robbins, and Joshua Ryan-Collins for their kindness and intellectual inspiration throughout the inception and creation of this paper. I would like to thank Romain Svartzman for his friendship and frequent communication about all things money! This paper could not have been written without the truly brilliant work of Nigel Dodd, David Graeber, Geoffrey Ingham, Friedrich Knapp, Alfred Mitchell-Innes, and Georg Simmel. All mistakes are mine alone.

Declarations of Interest: none.

References

Aglietta, Michel. 2018. Money: 5000 Years of Debt and Power. Translated by David Broder. London New York: Verso.

Alexander, David, and Véronique Blum. 2016. “Ecological Economics: A Luhmannian Analysis of Integrated Reporting.” Ecological Economics 129 (September): 241–51. https://doi.org/10.1016/j.ecolecon.2016.06.020.

Ament, Joe. 2019. “Toward an Ecological Monetary Theory.” Sustainability 11 (3): 923. https://doi.org/10.3390/su11030923.

Barwell, Richard. 2016. Macroeconomic Policy after the Crash: Issues in Monetary and Fiscal Policy / Richard Barwell. London: Palgrave Macmillan.

Bjerg, Ole. 2016. “How Is Bitcoin Money?” Theory, Culture & Society 33 (1): 53–72. https://doi.org/10.1177/0263276415619015.

Campiglio, Emanuele. 2016. “Beyond Carbon Pricing: The Role of Banking and Monetary Policy in Financing the Transition to a Low-Carbon Economy.” Ecological Economics 121 (January): 220–30. https://doi.org/10.1016/j.ecolecon.2015.03.020.

Chick, Victoria, and Dow. 1992. On Money, Method and Keynes: Selected Essays. New York, N.Y: Palgrave Macmillan.

Cirillo, Renato. 1986. “Leon Walras’ Theory of Money.” The American Journal of Economics and Sociology 45 (2): 215–21.

Daly, Herman. 1977. Steady-State Economics : The Economics of Biophysical Equilibrium and Moral Growth / Herman E. Daly.

———. 1994. For the Common Good: Redirecting the Economy toward Community, the Environment, and a Sustainable Future / Herman E. Daly and John B. Cobb, Jr. ; with Contributions by Clifford W. Cobb. 2nd ed., updated and expanded.. Boston: Beacon Press.

Di Muzio, Tim, and Richard H. Robbins. 2017. An Anthropology of Money: A Critical Introduction. 1 edition. New York: Routledge.

Dittmer, Kristofer. 2015. “100 Percent Reserve Banking: A Critical Review of Green Perspectives.” Ecological Economics 109 (January): 9–16. https://doi.org/10.1016/j.ecolecon.2014.11.006.

Dodd, Nigel. 1994. The Sociology of Money: Economics, Reason & Contemporary Society. 1St Edition edition. New York: Continuum Intl Pub Group.

Douai, Ali. 2009. “Value Theory in Ecological Economics: The Contribution of a Political Economy of Wealth.” Environmental Values 18 (3): 257–84.

Dyson, Ben, Tony Greenham, Josh Ryan-Collins, and Richard Werner. 2011. “Towards a Twenty-First Century Banking and Monetary System, Submision to the

Independent Commission on Banking." London, UK: Independent Commission on Banking. https://positivemoney.org/wp-content/uploads/2010/11/NEF-Southampton-Positive-Money-ICB-Submission.pdf.

Farley, Joshua, Matthew Burke, Gary Flomenhoft, Brian Kelly, D. Murray, Stephen Posner, Matthew Putnam, Adam Scanlan, and Aaron Witham. 2013. "Monetary and Fiscal Policies for a Finite Planet." Sustainability 5 (6): 2802–26. https://doi.org/10.3390/su5062802.

Fayazmanesh, Sasan. 2012. Money and Exchange: Folktales and Reality. 1 edition. London: Routledge.

Gaard, Greta, and Lori Gruen. 1993. "Ecofeminism: Toward Global Justice and Planetary Health." Society and Nature. http://lgruen.faculty.wesleyan.edu/files/2011/05/Gaard.pdf.

Gardiner, Geoffrey. 2004. "The Primacy of Trade Debts in the Development of Money." In Credit and State Theories of Money: The Contributions of A. Mitchell Innes, edited by L. Randall Wray. Cheltenham, UK ; Northampton, MA, USA: Edward Elgar Pub.

Graeber, David. 2014. Debt: The First 5,000 Years. Upd Exp edition. Brooklyn: Melville House.

Grierson, Philip. 1977. The Origins of Money. Athlone Press.

Henry, John. 2004. "The Social Origins of Money: The Case of Egypt." In Credit and State Theories of Money: The Contributions of A. Mitchell Innes, edited by L. Randall Wray and A. Mitchell Innes. Cheltenham, UK ; Northampton, MA, USA: Edward Elgar Pub.

Huber, Joseph. 2014. "Modern Money Theory and New Currency Theory." A Comparative Discussion, Real-World Economics Review, no. 66: 38–57.

Hudson, Michael. 2004. "The Archaeology of Money: Debt vs. Barter Theories of Money's Origins." In Credit and State Theories of Money: The Contributions of A. Mitchell Innes, edited by L. Randall Wray and A. Mitchell Innes. Cheltenham, UK ; Northampton, MA, USA: Edward Elgar Pub.

Humphrey, Caroline. 1985. "Barter and Economic Disintegration." Man 20 (1): 48–72. https://doi.org/10.2307/2802221.

Ingham, Geoffrey. 1996. "Money Is a Social Relation." Review of Social Economy 54 (4): 507–529. https://doi.org/10.1080/00346769600000031.

———. 2004a. The Nature of Money. 1 edition. Cambridge, UK ; Malden, MA: Polity.

———. 2004b. “The Emergence of Capitalist Credit Money.” In Credit and State Theories of Money: The Contributions of A. Mitchell Innes, edited by L. Randall Wray and A. Mitchell Innes. Cheltenham, UK ; Northampton, MA, USA: Edward Elgar Pub.

Innes, A. Mitchell. 1913. “What Is Money?” The Banking Law Journal 30.

———. 1914. “Credit Theory of Money.” The Banking Law Journal 31.

Jackson, Tim, and Peter A. Victor. 2015. “Does Credit Create a ‘Growth Imperative’? A Quasi-Stationary Economy with Interest-Bearing Debt.” Ecological Economics 120: 32–48. https://doi.org/10.1016/j.ecolecon.2015.09.009.

Jordan, Geraldine J., and Marie-Josée Fortin. 2002. “Scale and Topology in the Ecological Economics Sustainability Paradigm.” Ecological Economics 41 (2): 361–66. https://doi.org/10.1016/S0921-8009(02)00035-6.

Kallis, Giorgos, and Richard B. Norgaard. 2010. “Coevolutionary Ecological Economics.” Ecological Economics, Special Section: Coevolutionary Ecological Economics: Theory and Applications, 69 (4): 690–99. https://doi.org/10.1016/j.ecolecon.2009.09.017.

Knapp, Georg Friedrich. 1924. The State Theory of Money. London: Macmillan & Co.

Krugman, Paul. 2012. “Banking Mysticism.” The Conscience of a Liberal (blog). March 27, 2012. https://krugman.blogs.nytimes.com/2012/03/27/banking-mysticism/.

Lawn, Philip. 2010. “Facilitating the Transition to a Steady-State Economy: Some Macroeconomic Fundamentals.” Ecological Economics 69 (5): 931–36. https://doi.org/10.1016/j.ecolecon.2009.12.013.

Mankiw, N. Gregory. 2013. Macroeconomics / N. Gregory Mankiw. 8th ed.. New York, NY: Worth.

Martin, Felix. 2015. Money: The Unauthorized Biography--From Coinage to Cryptocurrencies. New York: Vintage.

Marx, Karl. 1970. Contribution to the Critique of Political Economy. Moscow: Progress Publishers.

Maucourant, Jérôme. 1993. “Au Coeur de l’économie Politique, La Dette. L’approche de J.R. Commons.” Revue Du MAUSS 2.

Meikle, Scott. 1994. “Aristotle on Money.” Phronesis 39 (1): 26–44.

Mellor, Mary. 1997. “Gender and the Environment.” In The International Handbook of Environmental Sociology, edited by Michael Redclift and Graham Woodgate. Cheltenham, UK ; Northampton, MA, USA: Edward Elgar.

———. 2009. “Ecofeminist Political Economy and the Politics of Money.” In Eco-Sufficiency and Global Justice: Women Write Political Ecology, edited by Ariel Salleh. London ; New York, NY : North Melbourne, Vic. : New York, NY: Pluto Press.

———. 2010. The Future of Money: From Financial Crisis to Public Resource. London ; New York : New York: Pluto Press.

Mill, John Stuart. 1974. Principles of Political Economy. Harmondsworth: Penguin Books.

Munda, Giuseppe. 1997. “Environmental Economics, Ecological Economics, and the Concept of Sustainable Development.” Environmental Values 6 (2): 213–233. https://doi.org/10.3197/096327107X243277.

Nelson, Anitra. 2001. “The Poverty of Money:: Marxian Insights for Ecological Economists.” Ecological Economics 36 (3): 499–511. https://doi.org/10.1016/S0921-8009(00)00248-2.

Norgaard, Richard B. 1989. “The Case for Methodological Pluralism.” Ecological Economics 1 (1): 37–57. https://doi.org/10.1016/0921-8009(89)90023-2.

Plumwood, Val. 1993. Feminism and the Mastery of Nature / Val Plumwood. Opening Out. London ; New York: Routledge.

Ricketts, Taylor. 2018. “Opening Plenary.” presented at the Research Agenda for Ecological Economics, Burlington, VT, August 14.

Ritter, Joseph A. 1995. “The Transition from Barter to Fiat Money.” The American Economic Review 85 (1): 134–49.

Roma, Antonio. 2006. “Energy, Money, and Pollution.” Ecological Economics 56 (4): 534–45.

Roma, Antonio, and Davide Pirino. 2009. “The Extraction of Natural Resources: The Role of Thermodynamic Efficiency.” Ecological Economics 68 (10): 2594–2606. https://doi.org/10.1016/j.ecolecon.2009.04.013.

Røpke, Inge. 2004. “The Early History of Modern Ecological Economics.” Ecological Economics 50 (3): 293–314. https://doi.org/10.1016/j.ecolecon.2004.02.012.

Russ, Meir. 2016. “The Probable Foundations of Sustainabilism: Information, Energy and Entropy Based Definition of Capital, Homo Sustainabiliticus and the Need for a

'New Gold.'" Ecological Economics 130 (October): 328–38. https://doi.org/10.1016/j.ecolecon.2016.07.013.

Ryan-Collins, Josh, Tony Greenham, Richard Werner, and Andrew Jackson. 2012. Where Does Money Come From?: A Guide to the UK Monetary & Banking System. 2nd edition. London: New Economics Foundation.

Samuelson, Paul. 1948. Economics: The Original 1948 Edition. 1 edition. New York: McGraw-Hill Education.

Say, Jean Baptiste. 1852. A Treatise on Political Economy : Or The Production, Distribution, and Consumption of Wealth.

Simmel, Georg. 2004. The Philosophy of Money. 3 edition. Abingdon, Oxon ; New York: Routledge.

Soddy, Frederick. 1930. Wealth, Virtual Wealth and Debt The Solution of the Economic Paradox. Omni.

———. 1935. The Role of Money; What It Should Be, Contrasted with What It Has Become. New York: Harcourt, Brace and Co.

Spash, Clive. 1999. "The Development of Environmental Thinking in Economics." Environmental Values 8 (4): 413–35.

———. 2012. "New Foundations for Ecological Economics." Ecological Economics 77: 36.

Svartzman, Romain, Dominique Dron, and Etienne Espagne. 2019. "From Ecological Macroeconomics to a Theory of Endogenous Money for a Finite Planet." Ecological Economics 162 (August): 108–20. https://doi.org/10.1016/j.ecolecon.2019.04.018.

Théret, Bruno. 1999. "The Socio-Political Dimensions of the Currency: Implications for the Transition to the Euro." Journal of Consumer Policy 22 (1): 51–79. https://doi.org/10.1023/A:1006142028937.

Walras, Leon. 1954. Elements of Pure Economics, or The Theory of Social Wealth. Translated by William Jaffe. Great Britain: Jarrold and Sons Ltd.

Wheelan, Charles, and Burton G. Malkiel. 2010. Naked Economics: Undressing the Dismal Science. Fully Revised and Updated edition. New York: W. W. Norton & Company.

Wray, L. Randall. 2004. "Conclusion: The Credit Money and State Money Approaches." In Credit and State Theories of Money: The Contributions of A. Mitchell Innes,

edited by L. Randall Wray and A. Mitchell Innes. Cheltenham, UK ; Northampton, MA, USA: Edward Elgar Pub.

———. 2015. Modern Money Theory: A Primer on Macroeconomics for Sovereign Monetary Systems. 2 edition. Houndmills, Basingstoke, Hampshire ; New York, NY: Palgrave Macmillan.

Chapter 3: Applying ecological monetary theory to a public banking system of sovereign money reform

Abstract:

While much attention has been given to the flawed modern monetary system, little attention has been given to the theoretical foundations that inform that system. Even less attention has been given to how changing our philosophical and theoretical approach to money could inform a new system. This paper draws on ecological monetary theory to explore a public banking system of sovereign money reform. Such a reform, while prolific in white papers and books, has received very little attention in the literature. This paper concludes that given the four policy levers—spend, lend, tax, interest—at a public bank's disposal, a system of sovereign money is capable of addressing the goals of justice and sustainability.

1.0 Introduction

The vast majority of the money supply in modern economies is created when commercial banks generate interest-bearing loans for individuals and corporations. This creates social and environmental problems as wealth is systematically transferred to the banking sector (Michel and Hudon, 2015) and resources are extracted to support an exponentially growing money supply (Robertson, 2012). This system of money creation is rooted in a mainstream economic theory in which money is a neutral veil that represents the underlying value of commodity exchange (Samuelson, 1948). Accordingly, the manner in which money is created and destroyed is viewed as unimportant relative to the

commodity exchange that money facilitates. Historically, this has informed a slow acquiescence of the power of money creation from the State to the commercial banking sector.

Ecological monetary theory defines money as a unit of account for denominating systems of credit and debt (Ament, 2019). Due to the power inherent in such systems, and the fact that the State determines and manages the unit of account, ecological monetary theory conceives of money as a social relation mediated by the State. Economic value and the biophysical impact of the money system are thus seen as constituted by the social relation of credit and debt and its manifestation in the unit of account. Ecological monetary theory, therefore, views who has the power to create and destroy money in and the manner in which money is used to claim resources as one of the most important topics in the modern economy.

This paper argues that theory informs how institutions are operated and regulated. Accordingly, an alternative theory such as ecological monetary theory can inform an alternative monetary institution such as a system of sovereign money. Conceiving of money as a social relation that claims resources—rather than a finite exogenous stock to be allocated—could inform a banking system in which social and ecological goals drive the system. Unlike in the current system in which the money supply is created by commercial banks, in a system of sovereign money, a public central bank would have full control of money creation through spending and lending and money destruction though taxes and interest payments. This paper considers how a system of sovereign money would restore the state's prerogative of money creation and provide the state with

powerful policy levers—spending, lending, interest, taxes—for achieving social and ecological goals.

Ecological monetary theory is rooted in ecological economics' goals of justice and sustainability. It therefore considers the money relation in terms of its social and biophysical impact. When considering monetary systems, both current and proposed, this paper considers justice according to the degree to which "inequality is limited within some acceptable range" (Daly, 1992). It considers sustainability as a function of the natural capacity of the "ecosystem to regenerate the inputs and absorb the waste outputs" (ibid) of economic activity. Importantly, it argues that, in a system of sovereign money, the central bank, through its creation and destruction capacity, has the ability to decrease the degree of inequality and increase the degree of sustainability of the society within which it operates.

2.0 The Modern Money System

2.1 Historical Background on European Central Banks

Joseph Huber argues that the State's monetary prerogative derives from its ability to determine the sovereign unit of account (currency prerogative), its ability to issue money denominated in that unit (legal tender prerogative), and in the benefit of first use of that money (seigniorage prerogative) (2014, p. 50). The prerogative of seigniorage has been largely acquiesced throughout history and informs the modern money system and the economic, social and ecological problems it engenders. It is also critical when considering sovereign money reform.

For much of money's history, rulers alone enjoyed the power to create and spend money (Huber, 2014, p. 48) as function of their ability to control resources (Mellor, 2015, p. 115) and their status as guarantor of the social network (Graeber, 2014, p. 56). This granted them the power to create as much money as was congruent with their ability to demand taxes. In the twelfth through fifteenth centuries, however, trade and monarchial expansion informed an evolution of the monetary role of the State. As rulers attempted to expand their power beyond what their taxation capacity allowed, they began to outsource the means of credit creation to commercial interests (Brown, 2013, p. 111; Davies, 2002, p. 261; Mellor, 2015, p. 115). As trade grew more vast and complex, coins and notes circulated throughout the world at the hands of private money changers (Aglietta, 2018, p. 137; Roberds and Velde, 2014; Velde, 2018).

While rulers continued to create money and demand taxation, trade imbalances and the wars of the twelfth through fifteenth centuries drained Europe of coin money and destabilized the unit of account (Aglietta, 2018, p. 109) as States increasingly shared monetary prerogative with bankers and money changers (Huber, 2016, p. 16). The details are different across space and time, but a general theme emerges from this intertwining of the public and private sources of the sovereign money: banks created credit money for both rulers and commercial interests well beyond the value of the claims they could honor at any given time (Robertson, 2012, p. 52). This created instability when customers feared their money could not be claimed or when the banking industry did not trust the payments system (Brown, 2013, p. 157).

Central banking emerged from this dynamic to stabilize the unrestrained and decentralized system of private credit creation (Timberlake, 1978, p. 27) by guaranteeing

the viability of private money in expiation of all public and private debts. From Genoa and Naples to Amsterdam and London, central public banks were chartered as either public banks that stabilized the private money supply through bill settlement and note exchange, or private banks that standardized the public money supply by circulating government deposits and debts (De Rosa, 2007, p. 263). Either way, central banks were not historically tasked with returning monetary sovereignty to the state, but, rather, with stabilizing bank money and monetizing the public debt.

2.2 How money is created

The modern money system emerges from this history of public and private intertwining as a system of private money backed by the public assurance of the central bank. Money is created in modern economies when commercial banks generate loans by crediting borrower's accounts with deposits (Wray, 2015, p. 84). When a borrower wishes to spend the newly created deposits, they may do so in one of three ways.

First, if the transaction involves customers of the same bank, a simple balance sheet transaction will transfer the deposit between the customers. Next, if the transaction involves customers of different banks, the respective banks will transfer reserves—accessible only to commercial banks for inter-bank transactions—between their accounts at the central bank. Each day, commercial banks net their reserve positions and borrow any necessary reserves from other banks on the interbank market, or should there be insufficient liquidity, from the central bank who creates and lends any reserves necessary to maintain the payments system. Finally, should a customer wish to spend their deposits in person, they may withdraw cash. Cash is only available to banks in exchange for

reserves, and is, thus, a physical representation of bank money (Ryan-Collins et al., 2012, p. 72).

As can be seen, reserves are created in response to lending in order to maintain liquidity in the interbank market. Importantly, they are not interchangeable with savings and do not limit lending, as orthodox monetary theory explains (Mankiw, 2013, p. 84). The modern money system is, thus, characterized by a two-circuit system in which commercial bank money circulates in a public circuit and central bank money—cash and reserves—circulates reactively in the interbank circuit to maintain stability and avert crises in the payments system (Huber, 2016, p. 6, 2014, p. 49).

2.3 Problems with the Modern Money System

2.3.1 Economic – Growth and Instability

Since the amount of principal that is loaned into the economy is always less than the principal and interest that must be returned to the bank, the overall money supply must always grow by the amount of interest to support general economic activity (Robertson, 2012, p. 103). While banks are eager to generate these loans during economic booms, during declines, money is removed from the economy faster than it is created. Accordingly, economic expansions and contractions are exacerbated by the banking industry in a structurally pro-cyclical and unstable manner (Minsky, 1977).

The architecture of the modern financial and monetary system can be understood as a complex system in which a tipping point can be reached (Scheffer et al., 2012), beyond which the collapse of the system is irreversible (Baldovin and Stella, 2007). Complex systems exhibit a high diversity of components and a “dense network of

interactions between these components" (Lietaer et al., 2012). The modern money system and the financial system it supports is characterized by a complex system of interdependent lending operations, derivative packages, asset repurchase agreements, foreign currency exchanges, and rehypothecated collateral operations (Brown and Simpson, 2012, pp. 179–199; Hudson, 2015; Lietaer et al., 2012).

Each of these components interacts with and is dependent upon the others. Accordingly, as any parameter reaches a critical point, "stress can generate interesting dynamics, such as default spillovers and fire-sale feedback loops, as shocks propagate through the system" (Flood et al., 2018). This complex dynamic is largely responsible for the global financial crisis of 2008. The credit default market had reached a critical point at roughly four times the US economy (Kiff et al., 2009) when the underlying mortgage asset bundles defaulted. Due to the interconnected networks involved, the monetary system reached a critical point where it collapsed and transitioned to a new state as evidenced by the unorthodox policy tools the Fed now utilizes (Bean et al., 2010).

2.3.2 Social

When the vast majority of economic activity must be undertaken to service the credit-based money supply, wealth is systematically transferred from borrowers and renters to lenders and landlords (Michel and Hudon, 2015, p. 161). This is especially true since investment returns almost always outpace economic growth (Piketty, 2014). Since one of the main sources of bank profit is household debt, resources are extracted from the real economy and concentrated in the banking sector (Lapavitsas, 2013). In fact, for every dollar the banking industry earns, sixty cents is lost from the productive economy

(Bregman, 2017, p. 169). This raises the general price of goods and services as interest and bank fees are internalized (Kennedy, 2012; Robertson, 2012, p. 102). As Mann writes, the infrastructural social power of money has been usurped by the despotic power of commerce to create the social money (1986).

2.3.3 Ecological

Given the growth imperative attendant to credit-based money, resources must be continually extracted from the environment to maintain aggregate demand in the face of steady prices (Robertson, 2012, p. 104). As Daly points out, this is not unique to goods since services also, ultimately, have a physical dimension (Daly, 1994, p. 412). Soddy argued that such a scenario embodied a contradiction since the physical nature of goods and services is entropic while the money that is used to measure those goods and services grows exponentially (Soddy, 1930). As he wrote, "you cannot permanently pit … the spontaneous increment of debt (compound interest), against the … spontaneous decrement of wealth (entropy)" (Soddy, 2012, p. 30).

2.3.4 Lack of Money to Finance Solutions to Problems

While a system of credit-based money fundamentally creates economic, social, and ecological problems, it also structurally blocks solutions to these problems since the only monetary circuit is profit-based. Since much public expenditure is cost-based (Mellor, 2015, p. 68), solutions must be funded through a mixture of public borrowing and commercial taxation (Mellor, 2010, p. 53). In fact, between 15% and 30% of tax revenues

are dedicated to servicing public debt (Huber, 2014, p. 47), siphoning funds from social and ecological needs.

Having acquiesced the prerogative of seigniorage, government has become "indebted to and dependent on the banks" (Huber, 2014, p. 48), and unable to address social and ecological issues through democratic means. Solutions to the problems discussed, thus, ultimately rest upon economic growth in the commercial sector that can then be taxed and used by the public sector (Mellor, 2015, p. 69). This engenders all the problems of growth (Daly, 2013a) in a feedback loop whereby addressing the problems of growth requires funding that is dependent on growth.

2.3.5 The Problem of Value

Perhaps the biggest problem with the modern money system—the one that engenders all the others—is that when a nation's money supply is created as private credit, what is given economic value are those activities that return a profit, ecological and social problems notwithstanding. In other words, the manner in which money enters society contributes to and shapes what is ascribed economic value (Robertson, 2012, p. 76; Svartzman et al., 2019, p. 116). This is in strong contrast to the idea that value inherent in commodities is the foundation of money

3.0 A System of Sovereign Money

While understanding money as a commodity informs a system in which it is allocated according to the workings of the market (Ingham, 2004, p. 12; Mellor, 2015, p. 154), understanding money as a social relation informs a different approach to money creation

and allocation. This section discusses sovereign monetary reform in which the prerogative of money creation is returned to the state through the central public bank and decentralized through a network of regional public banks. Similar proposals are often called ‘public money’, or ‘plain money’ (Dittmer, 2015) and are associated with the ‘Sovereign Money’ (Huber, 2014) and ‘Positive Money’ (Jackson and Dyson, 2012) movements in Europe.

It should be noted, that, while the goals are similar, sovereign money as discussed below is distinct from full-reserve banking proposals that aim to eliminate the ability of commercial banks to create money by requiring they hold an amount of reserves equal to their deposit liabilities. Restricting the ability of commercial banks to create money does not require reserve requirements; it requires the separation of deposit-holding and savings-lending services so money cannot exist as both a deposit and a loan, and the elimination of lender of last resort facilities.

If lender of last resort facilities are not eliminated, banks may generate any loan they deem profitable and borrow full reserves from the central bank (Huber and Robertson, 2000, p. 23; Jackson, 2013). And if deposit holding and savings lending services are not divorced, a lender of last resort is necessary to maintain stability. By separating deposit holding from savings lending, and by eliminating the lender of last resort facility, a public central bank eliminates the dual circuit of money where public money (cash and reserves) supports private money (loans). In this manner public banking is distinct from and goes much beyond full-reserve banking by eliminating the reserve circuit (Bacchetta, 2018).

In the current reserve system of banking, the government generates revenue by levying taxes (Huber, 2014, p. 47) and issuing bonds (Ryan-Collins et al., 2012, p. 122). Each of these transactions involves transferring reserves between commercial bank and Treasury accounts at the central bank. Since, as discussed, reserves are created in response to commercial lending, the central bank's sole manner of controlling the money supply is through setting the interest rate at which it lends reserves to commercial banks (Dittmer, 2015, p. 10). This dynamic creates a two-circuit system in which central bank money circulates to provide a backstop to commercial bank money (Mellor, 2015, pp. 71–73, 123). And while some commercial bank money is siphoned to the government for taxes and bonds, the central bank and Treasury are ultimately responsive to commercial activity.

The following considers a system of sovereign money that eliminates the two circuit system and replaces it with a single circuit in which the central bank fully manages the money supply through spending and lending (Jackson, 2013; Mellor, 2015, p. 156). This gives it powerful policy tools to control the economy and pursue goals of equity and sustainability. The following explores this dynamic.

3.1 How the National Public Bank would create and destroy money

In a system of sovereign money, the national central bank would have a monopoly on creating the money that circulates in the economy through its spending and lending operations (Dyson et al., 2014). The central bank would spend money into existence by increasing the balance of the government's Treasury account at the central bank (Huber and Robertson, 2000, p. 9). The government would then use that money for spending on

public services and investment in infrastructure without first needing to tax or borrow, as it does now. Beyond direct spending, central bank money could also be used to provide a citizens income that would inject money directly into the economy. The government would also lend money into existence based upon the credit needs of the economy (Ryan-Collins et al., 2012, p. 144). This would be done by lending directly or by lending to regional, state or municipal public banks that would on-lend to businesses and individuals.

In a system of sovereign money, the central bank would also have a monopoly on destroying the money supply through its taxing and interest payment mechanisms. Taxation would provide a mechanism to remove credits from the economy to stabilize the unit of account and express policy goals, but, importantly, not to fund spending (Ruml, 1946). Similarly, interest payments on the credit that the central bank had lent into the economy, would destroy money by removing it from the economy. It is important to note that taxation and interest payments do not allow spending and lending, but, rather, provide a policy tool with which the central bank can express goals. This will be explored below.

3.2 How Regional Public Banks would facilitate payments and lend to businesses

In a system of sovereign money, regional public banks would operate beneath the national bank and perform two functions: providing safekeeping and payments services for customer deposits, and lending customer savings to borrowers. These banks would operate at the regional, State, and Municipal levels. By separating deposit-taking and savings-lending operations, money held as a customer deposit could not exist

simultaneously as a loan and the deposit-taking role of the regional bank would be limited to safekeeping money and administering payments between customers (Dittmer, 2015, p. 10; Jackson and Dyson, 2012, p. 178).

In the current monetary system, deposits do not legally belong to customers and exist instead on bank balance sheets as a liability (Huber and Robertson, 2000, p. 23). In a system of sovereign money, deposits would reside at the central bank and remain legal property of the customer (Bacchetta and Perazzi, 2018, p. 2; Brown, 2013, p. 246). Accordingly, deposit insurance would be unnecessary (Jackson and Dyson, 2012, p. 180) and deposit accounts would provide a safe place for citizens to store their money, much like people think they do today (Ryan-Collins et al., 2012, p. 11).

The second role of regional banks would be to allocate funds between savers and borrowers (Dittmer, 2015, p. 10). If a deposit customer wished to earn a return, the bank would transfer funds from their deposit account to an investment pool at the central bank. If a borrower wished to take out a loan, the bank would transfer funds from the investment pool to the customer's deposit account. In the process of managing the investment pool, banks would combine the funds of many individual savers with funds borrowed from the central bank to extend credit according to the needs of the region and the social and ecological goals of the bank.

Since both deposit and lending funds would be held at the central bank, the role of the regional public banks would be that of a middleman. Banks would relay information between customers and the central bank and manage the movement of money between the distinct investment and payment systems.

Also, while a centralized money system is critical to the economic health of a nation (Brown, 2013, p. 145; Mellor, 2015, p. 67), centralized monetary policy is ill-equipped to address the diverse needs of regional economies. Regional public banks could provide different lending rates for different geographies and utilize its local knowledge to incentivize and disincentive activities through its interest rate facility without acquiescing control to private banks. Such a regional monetary policy could also prevent capital flight from small, poor regions to large, rich ones (Hakenes and Schnabel, 2006), while also tailoring loan portfolios to stimulate market activity while avoiding the social and ecological costs of such lending.

3.3 How the money supply would be managed

While restoring legal tender prerogative to the public sector removes the profit motive from the money supply, it risks political influence over money creation (Chen et al., 2018; Shen and Lin, 2012). Accordingly, the entity that determines how much money is created should not benefit from that creation (Dyson et al., 2014, p. 26). The state's seigniorage prerogative should, thus, be a function of a democratic system of checks and balances between money creation and use.

In a public banking system of sovereign money, a monetary agency would be tasked with determining the money supply based upon macroeconomic data such as inflation or unemployment, and democratically-determined goals such justice or sustainability. The agency would then determine how that money supply would be divided between direct government spending and government-led lending (Dyson et al., 2011, p. 10).

The government would determine how it would divide its funds between direct spending, cutting taxes, or citizen payments. The regional banking system would on-lend according to the needs of borrowers and according to the goals of the central bank. During the next cycle of money creation, the monetary agency would remove money as a function of its economic targets and social and ecological goals through taxation or calling in loans (Farley et al., 2013, pp. 2813–2814) and begin the process again.

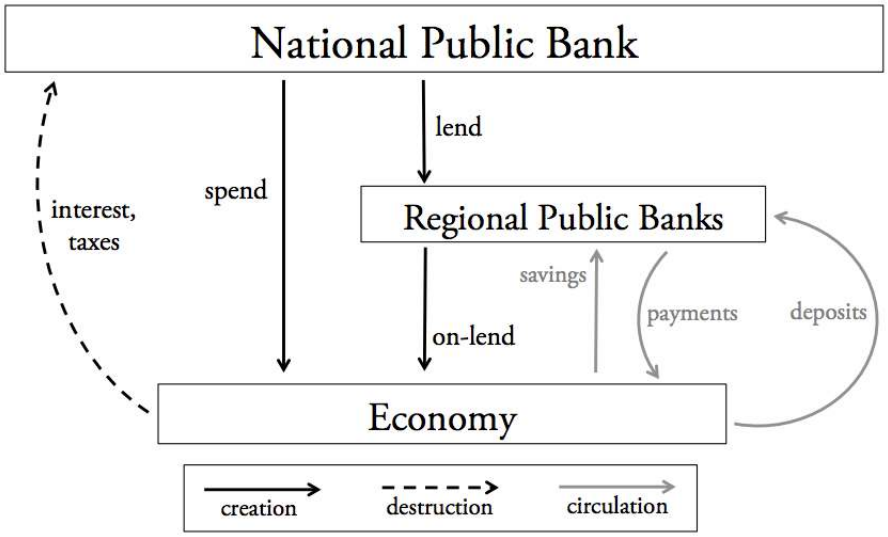
By separating legal tender and seigniorage prerogatives, the agency would have no control over how the money supply is used and the government would have no control over the size of the money supply. This would separate political and corporate conflicts of interest and eliminates the ability of the issuer of money to benefit from its creation.

4.0 Sovereign Money Policy Tools

In the modern monetary system, the government has two mechanisms for controlling the economy, monetary and fiscal policy. Each mechanism, however, is weak and reactive to the commercial-led money circuit. Modern monetary policy is aimed at influencing the interest rate at which banks lend reserves in the overnight market with the goal of limiting or expanding lending. Research has shown, however, that interest rates tend to respond to, rather than influence, lending activity (Werner, 2011). Similarly, as discussed above, fiscal policy (taxation and spending) is conducted by transferring reserves between commercial and government accounts at the central bank. This leaves governments dependent upon the commercial credit circuit for its spending needs.

A system of sovereign money allows central banks and governments to transition from weak and reactive monetary and fiscal policy to strong and proactive creation and

destruction policy. Figure 1 summarizes the sovereign money system discussed above. Importantly, it shows how a national public bank would control the money supply through creation and destruction, and how regional public banks would manage the payments system and lend savings to borrowers.



Money Lifecycle in a System of Sovereign Money

(Figure 1)

In a system of sovereign money, the central bank would have full control of the money supply through the four policy levers of spending, lending, taxes, and interest. These policy levers are indicated by the solid and dashed black arrows in Figure 1. The grey arrows in Figure 1 indicate how money would circulate in the economy. Creation policy would consist of the tools of spending and lending, while destruction policy would be constituted by interest payments and taxes. Through these four policy levers, the central bank would have considerable power in addressing the goals it sets.

4.1 Policy Tools for Achieving Justice and Sustainability

The following considers how a public central bank in a system of sovereign money could use the four policy tools discussed above to achieve ecological economics' goals of justice and sustainability. Importantly, it uses ecological monetary theory's conceptualization of money as a social claim on resources to explore the tools at the central bank's disposal (Ament, 2019). Drawing from Daly (1992), this section considers how the central bank could use the tools at its disposal to move a society toward a more just distribution of income and wealth and a more sustainable biophysical relationship.

As Daly writes, sustainability can be thought of in terms of the space between the capacity of the ecosystem to regenerate productive inputs and absorb waste outputs in a manner that does not threaten provision of life-sustaining ecological function (Daly, 1992). This includes the capacity of oceans to produce food, forests to produce lumber, and grasslands to produce food. It also includes the atmosphere's capacity to maintain a stable climate, watersheds' capacity to clean waste, and ocean's capacity to sequester carbon. Policy that increases the ecosystems capacity for regeneration and absorption is desirable.

Justice is a function of the distribution of the resources that society creates from the resources it manages (Mcmahon, 1997). This could be viewed vis-à-vis the relative division of the flow of resources (Daly, 1992), the concentration of the wealth earned from that flow (Piketty, 2014), or the power inherent in the initial endowment of those resources (Spencer et al., 2018). Policy that increases the distribution of resources, or that decreases the concentration of resources, is desirable.

Broadly speaking, money creation policies—either spending or lending—allow a central bank to direct money into the economy. Money destruction policies—taxing and interest payments—allow a central bank to regulate the outcomes of economic activity and increase the capacity for money creation. As a toolkit, these four policies allow the central bank to allocate resources between public and private investments according to the goals of sustainability and justice.

4.1.1 Spending

While the modern monetary system limits a government's ability to spend based upon its ability to tax or sell bonds (Ryan-Collins et al., 2012), the government within a sovereign money system could use spending as a policy tool without the need to tax or borrow (Brown, 2019, p. 262). By spending money into existence, the government would be able to influence socially-necessary and ecologically-sustainable goods and services. This includes public education, healthcare, environmental restoration, and subsidies to limit environmentally-destructive activities. For example, in the case of freshwater phosphorus eutrophication (Wironen et al., 2018), spending could be aimed at removing phosphorus from the water body or providing a subsidy to farmers to limit phosphorus imports. Both of these policy tools would be undertaken according to the capacity of the ecosystem to absorb phosphorus waste emissions.

As a policy tool, spending could be used to address income and wealth inequality by paying a universal basic income or income for home labor. It could also be used to fund tuition-free higher education or universal healthcare (Brown, 2019, p. 293). Spending could also take the form of interest payments on deposit accounts that citizens

hold at the central bank (Berentsen and Schar, 2018; Brown, 2019, p. 246). While in the current system only commercial banks are able to hold interest-bearing deposits at the central bank, paying individuals interest on the deposits they hold could reduce inequality by shifting money from the banking industry to citizens.

Money in circulation would then flow toward those industries that surround where the money is spent (Mellor, 2015, p. 152), allowing the government to influence the commercial sector through more than just regulation. This spending would inform a seismic shift in what is ascribed economic value (Hanna, 2018, p. 93; Robertson, 2012, p. 76) and allow public spending to be seen as a productive investment in which returns flow to the public, not simply expenditure (Mazzucato, 2018, p. 264). It would also eliminate waste by provisioning socially-necessary work rather than waiting for commercial money to be taxed before it can be spent (Mellor, 2010, p. 163).

4.1.2 Lending

While spending is a powerful tool to inject money into the economy, the central bank could also lend money into the economy in order to provide businesses and individuals with access to credit (Fettig, 2002). In fact, the central bank's ability to issue credit was used in 2008 to lend liquidity to AIG, Bear Stearns, GE, McDonalds, and Verizon incredibly low interest rates (Brown, 2019, p. 255). Given the goals of justice and sustainability, however, the central bank could direct money into sectors such as healthcare, energy, transportation, and education, and provide another lever for the government to influence economic value.

Lending would be based on qualitative criteria including the requirement that loans only be underwritten for businesses and individuals in the non-financial sector in order to eliminate speculation (Brown, 2019, p. 271). Speculation is partially a function of the manner in which money is created. When money is created as interest-bearing debt, principal and interest are continually rolled-over into speculative instruments that seek increases in the underlying asset (Denning, 2013). When the money supply is no longer a function of lending, loans can be created in alignment with the goals of sustainability and justice and the money supply would be a function of socially-productive activity.

Lending would also be based on quantitative criteria given the social, ecological, and economic goals set by the monetary agency. Importantly, as will be discussed below, the interest rates on different loans would provide the central bank with a critical policy tool to allocate money between public and private investment.

4.1.3 Tax

Taxation is one of the most effective policy tools for achieving the goals of justice and sustainability. Taxes include fees, fines, and any tool other than interest that the government uses to pull money out of circulation. While in the current system, taxes facilitate government spending by transferring money from the banking circuit to the government (Huber, 2014), in a sovereign money system, spending is not reliant upon taxation. Instead, taxation would be used 1) as a policy tool to deter undesirable activities and outcomes, and 2) to remove money from circulation in order to facilitate spending

and lending. Together, taxation would be used as a tool to allocate resources between public and private investment.

For example, a carbon tax could be assessed in order to limit the amount of gasoline used in transportation. By removing money from circulation, the carbon tax could increase the capacity of governments, ceteris paribus, to spend or lend for renewable energy research and development. Similarly, a tax on income would remove money from circulation to improve the distribution of income and increase the capacity of the government to spend on citizen income payments or healthcare or education programs. Importantly, neither of these examples would rely upon the tax to fund the subsequent spending. Rather, the tax would be used to express public policy and reallocate resources (Ruml, 1946).

Taxes could also be used to prevent speculation. As discussed above, the financial system is a complex system that is largely unregulated and therefore untaxed. While a central public banking system would eliminate much of the financial speculation that is undertaken to hedge against interest-rate and liquidity risk (Tolle, 2016), much speculation is undertaken in order to accumulate wealth. A financial transaction tax can be used to deter financial speculation and allocate funds to the public purpose (Brown, 2019, p. 316). Similarly, capital gains taxes could be used to target asset speculation in financial as well as real-estate markets.

4.1.4 Interest

In a public banking system of sovereign money, interest payments provide a similar policy tool as taxes: to destroy money. As has been discussed, money destruction

increases the public central bank's capacity to spend or lend, and provides it with a powerful policy tool to allocate money between public and private purposes. Importantly, like with taxes, removing money from circulation through interest payment would not raise money for spending but would reallocate wealth from the private to the public sector.

While taxes, fees, and fines are diffuse in the economy, interest payments provide a very specific tool for targeting social or ecological goals. High interest rates on undesirable activities would deter private investment, especially in unjust or unsustainable activities, and increase money destruction. Low interest rates could allow the central bank to direct just and sustainable economic activity (Huber and Robertson, 2000, p. 10). For example, the Bank of North Dakota provides public agencies, local businesses, and residents with low interest rates (Hardmeyer, 2012). It also offers interest-free loans for infrastructure projects. This has reduced the cost of projects by an average 40 percent (Brown, 2013, p. 365), moving wealth from the banking sector to the public where it can be invested according to the goals of the state.

Investment in research and development in ecological restoration and alternative energy is necessary to address the environmental crises we face (Nielsen‐Pincus and Moseley, 2013). In the current system, this investment is a function of the return on investment for the private sector, or the capacity of the public sector to raise tax revenue. In a system of sovereign money, interest rates are a powerful mechanism for driving investment away from the private sector and toward the public sector. For example, increasing interest rates on research and development borrowing would allow the central

bank to reallocate investment in collective action problems (Farley et al., 2015) from private corporations such as Boeing toward public agencies such as NASA.

Importantly, rather than going to banks as profit, interest would be destroyed upon repayment and would be seen as a fee for using money. That fee could be zero for first time homeowners or much higher for investment real-estate, a policy position the central bank could express given its massive liquidity (Brown, 2019, p. 327). Accordingly, since interest payments would not be reinvested into new loans, they would no longer be a structural component of the money supply and speculation would be limited. Accordingly, interest rate policy would transition from a weak and reactive tool of the central bank to a strong and proactive tool that guides policy (Brown, 2019, p. 316; Werner, 2011).

4.2 Using the Four Policy Levers Together

As the section above has discussed, a system of sovereign money provides the central bank with powerful levers to fold monetary policy and fiscal policy into creation and destruction policy in order to achieve the goals of justice and sustainability (Figure 2). Spending and lending operations create money for the economy and allow the central bank to inform and shape economic value according to its goals. Tax and interest payments remove money from the economy to explicitly deter undesirable activities and outcomes, and to create room for spending and lending.

Creation		Destruction	
Spend	Lend	Tax	Interest
Issue money into society by spending on social and ecological needs. • Not dependent upon tax or interest revenue.	Issue money into society by extending credit for what society needs. • Discriminate against unjust or unsustainable activity.	Remove money from society by levying taxes, fees, and fines upon undesirable social and ecological activities and outcomes.	Remove money from society by collecting interest payments on loans. • Allocate between private and public investment.

Summary of the Four Policy Levers of a Public Central Bank

(Figure 2)

Together, these four policy levers allow the government, through its central bank, to achieve its goals through tools other than direct regulation. Rather than creating laws on activities, regulation would largely occur through discrimination on spending and lending and manipulating taxes and interest rates in accordance with policy positions.

The vast financial transactions industry provides an excellent example of how these four policy levers can be used together to achieve goals of sustainability and justice. Financial transactions amount to more than five quadrillion dollars annually in the United States alone (Smith, 2017). Scott Smith calculates that a financial transactions tax of only one-tenth of one percent would 1) drastically limit investment in financial speculation, 2) reallocate funds to fully fund universal healthcare and universal higher education, and 3) reallocate funds to fully fund an unconditional basic income (Brown, 2019, p. 318). Since the liquidity currently leveraged for financial speculation is largely interest-free (Brown, 2019, p. 326), interest rate policy could also be used alongside taxation to deter financial

transactions. Coupled with informing economic value, these four policy levers would give the government much control in achieving goals of sustainability and equity.

4.3 This is not radical

A public central bank with full monetary prerogative is not a radical proposal. Milton Friedman (1960), Henry Simons (1948), and Irving Fisher (1936) all advocated for a nationalized money supply, arguing that the banking industry's monopoly of the monetary lifecycle distorts market equilibrium. Given that competition and regulation have proven ineffective, nationalizing the money supply is often seen as the most market-friendly solution (Alperovitz, 2012).

Accordingly, sovereign money can "short circuit the relationship between the revolutionary and the conservative" (Bjerg, 2014, p. 263). This can be seen in the fact that post-Kenyesian 'reformist' approaches to non-structural monetary system change rest on the otherwise 'transformative' assumption that banks distribute their profits to society (Bacchetta and Perazzi, 2018; Cahen-Fourot and Lavoie, 2016; Jackson and Victor, 2015; Svartzman and Ament, 2019). In other words, in the post-Keynesian models, sovereign money can be seen as short-circuiting the distance between 'reformist' and 'transformative' approaches.

Perhaps most importantly, however, a banking system in which legal tender and seigniorage prerogative are returned to the state is exactly how most people, including most economists, conceive of banks today. By assuming legal tender and seigniorage prerogative, the state would uphold and manage money's nature as an infinite social relation and allow it to become the finite exchangeable commodity of which it is

conceived in theory only when it enters the economy. Regional banks would then operate like intermediaries who specialize in gathering information in order to allocate a stock of money according to interest as a function of social and ecological goals (Bjerg, 2014, p. 265; Dittmer, 2015, p. 10; Farley et al., 2013, p. 2812; Mellor, 2010, p. 161; Robertson, 2012, p. 115).

This dynamic between the state's monetary prerogative and the movement of money as a commodity short-circuits the space between ecological monetary theory's focus on money's socio-ecological relation and the orthodox focus on money's commodity function.

5.0 Discussion: The Benefits of a Sovereign Money System

5.1 The benefits of a system of public banking

When the current system of commercial-bank-led money creation is transitioned into one in which the state retains full legal tender and seigniorage prerogative, with the fours policy tools discussed above, many of the problems associated with the bank-led money system would be eliminated. Broadly, the benefits of a public banking system of sovereign money fall into four categories: economic, government, social, and ecological.

5.1.1 Economic

Having removed the ability of commercial banks to leverage deposit liabilities against risk-bearing loans, deposit insurance would be unnecessary and the moral hazard of the central bank to act as lender of last resort would be eliminated. Together, this would create a more stable and less risky monetary, and therefore economic, system.

Perhaps more importantly, however, since the money supply would no longer be a function of bank profitability, the central bank could use the four policy tools at its disposal to maintain a money system that is counter-cyclical and self-limiting (Brei and Schclarek, 2015; Dyson et al., 2011, p. 5). In fact, multiple studies have noted that public bank lending is significantly less cyclical than that of private banks (Duprey, 2013; Yeyati et al., 2007) and that public banks have an increased capacity to mitigate economic downturns (Coleman and Feler, 2015).

5.1.2 Government

Restoring legal tender prerogative allows the central bank to operate in quantity space, as opposed to the inefficacious and indirect price space it does now (Werner, 2011). Accordingly, the government can use both lending and interest policy to affect sustainability and justice in a way the private banking industry cannot. By controlling both the money supply and the payments system, the central bank would no longer be responsible for providing a backstop to the structurally-vital banking sector and its focus could be social and environmental goals.

Restoring seigniorage prerogative would make the profit of money creation available to the central bank to use on social and environmental needs rather than being siphoned away by the banking industry (Bjerg, 2014, p. 264). This would eliminate the need to borrow from capital markets and the national debt would simply be a function of the state's promise to accept its own credits in expiation of the debts it levies (Ingham, 2004, p. 198).

Since bank money is always backed by the public money, the privatized money supply is an illusion (Mellor, 2015, p. 68, 2010, p. 160). By realigning benefits with responsibilities, public banking gives the state control of the system it is responsible for maintaining and provides it with four levers to achieve its social and ecological goals.

5.1.3 Social

Perhaps the greatest benefit of a public banking system of sovereign money is that the money supply would be a function of democratic choice rather than individual accumulation (Lapavitsas, 2010). This would severely limit speculation (Brown, 2019, p. 270), reducing the interest burden on prices in the general economy and increasing purchasing power (Kennedy, 2012). This is especially true in the housing sector where real-estate speculation drives housing prices and rental rates (Ryan-Collins et al., 2017).

A speculative money supply creates structural inequality as wealth is siphoned from poor borrowers and renters to wealthy lenders and landlords (Michel and Hudon, 2015). Inequality is reduced, however, when investment is limited to savings and interest is only transferred from those who abstain from consuming to those who wish to consume more (Daly, 2013b). Similarly, a public banking system of public money would use structural tax policy to manage the money supply and address income inequality (Ruml, 1946).

Beyond purchasing power and income inequality, public banks could lend more frequently to small businesses (Ogura, 2018; Villar et al., 2016). And during exogenous economic crises, public banks more effectively maintain stable credit options to the most vulnerable households (Lapavitsas, 2010).

5.1.4 Environmental

Transitioning from an interest-bearing money supply eliminates the monetary growth imperative (Svartzman and Ament, 2019) and the extraction necessary to maintain purchasing power. The money supply in a public banking system could, thus, be managed according to ecological health, shrinking if necessary without affecting the stability of the unit of account (Douthwaite, 1999, p. 32).

Commercial banks, focused on short-term profits and temporally-fragile lending portfolios (Gaffney, 2009a, p. 860), tend to underprovide credit for environmental projects that are often long-term and low-return by nature (Fullerton, 2011). Public banks, however, are not beholden to shareholders and have essentially unlimited access to liquidity. Accordingly, they are able to provide the financing terms that environmental projects require (Rezende, 2015).

5.2 How a Public Bank Could Move Toward Justice and Sustainability

The value of money in the commercial-bank led monetary system is a function of the social/political conflict between the rate of interest and the profitability of enterprise on the one hand, and the state on the other (Ingham, 2004, pp. 201, 131). This system forces us to "generate comparative money values that motivate us to compete with one another and destroy the resources of the planet" (Robertson, 2012, p. 76). A system of public banking could break that conflict and allow economic value and purchasing power to be a function of democratic and environmental goals. If money value is not a function of profit, it can be affordably spent on social and environmental expenditure—and to

address social and environmental problems—without causing inflation, debt, or tax increases.

The following section will consider several studies to explore how the central bank in a system of sovereign money could use the four policy levers at its disposal to affect justice and sustainability. Rather than defining justice or sustainability directly, this discussion will discuss the study considered in the context of the modern money system and explain how a central bank in a system of sovereign money could use its policy tools to move the system to a more acceptable range of justice or sustainability (Daly, 1992).

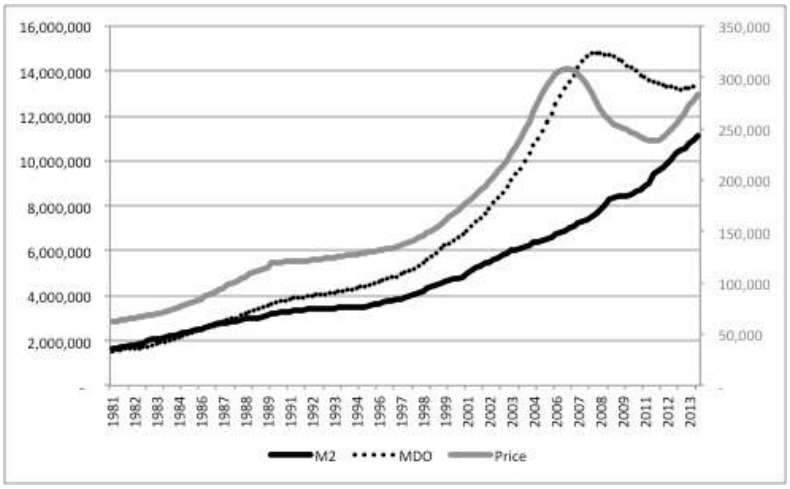
5.2.1 Home Price and Money Supply

Economist Michael Hudson argues that the price of a home is a function of the amount a bank is willing to lend to purchase the home (Hudson, 2010). To consider this claim, I analyzed mortgage debt outstanding, average home price, M2 money supply (cash, checking, savings, mutual funds, and money market securities), and Mortgage Rates from 1981-2013 in the United States[1]. Figures 3 and 4 discuss my findings.

In Figure 3, the relationship between MDO, the M2 Money Supply, and average home price in the United States is examined. While causality between mortgage debt outstanding (MDO) and home price is difficult to prove, the tight relationship between the two, denoted by a correlation coefficient of .92, seems to partially confirm Hudson's argument. This is especially true given that the M2 money supply and mortgage debt outstanding were tightly correlated until the banking deregulation of the late eighties.

[1] Author calculations. M2 Data, Mortgage Debt Outstanding, and Mortgage Rate data from FRED, Federal Reserve Bank of St. Louis; Average Home Price data calculated from Lincoln Institute of Land Policy

One effect of that deregulation was that mortgages could be repurchased in the derivatives market and, therefore, not be counted as a deposit in the M2 money supply (Francis et al., 2014). Accordingly, when MDO and M2 begin to diverge in 1987, the correlation between MDO and Price increased relative to that of MDO and M2, suggesting that speculative mortgage debts in the derivative markets were driving home prices.

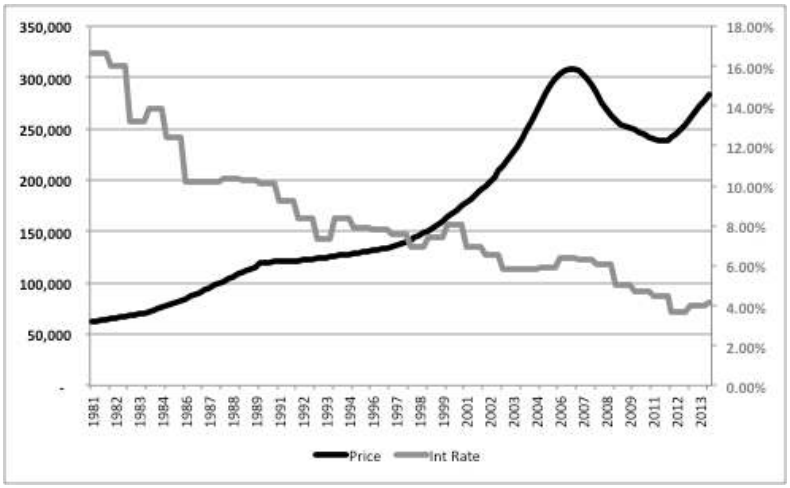


Money Supply, Mortgage Debt, and Home Prices

(Figure 3)

Figure 4 demonstrates the relationship between the Average Mortgage Rate and Home Prices in the United States. While other factors are certainly important, the inverse relationship suggests that as interest rates decrease, the price of homes increases. Importantly, it seems to suggest that Hudson's argument may be true for a different reason than discussed above. Figure 4 seems to suggest that, given a borrower's total capacity to borrow, when interest rates decrease, the amount dedicated to principal, and

thus price, increase. Accordingly, the amount borrowed is a function of interest rates and seems to drive home price.



Central Bank Interest Rates and Home Prices

(Figure 4)

In the bank-led monetary system, the money supply is largely a function of bank lending. Accordingly, interest rate policy is used to increase or decrease the money supply. The figures in this section show how this system operates to increase home prices. As home prices increase, rents follow, and in a bank-led money system, incomes tend to rise at a slower rate than rent (Hodgson, 2013). This creates a situation in which an increasing share of income is channeled to the banking sector that generates loans and the landlords who own rental property. Further, in the United States, capital gains are tax exempt if rolled into a new home or commercial mortgage, further contributing to home price increases and transferring wealth to the banking industry.

The following outlines how three of the four policy levers at the disposal of the central bank in a system of sovereign money are capable addressing the problems in this study and moving the degree of inequality, as Daly writes, toward a more acceptable range (1992).

- **Interest:** Interest rates could be high for second homes or homes that are not the owner's primary residence and low for first-time homebuyers or young families. This could have the effect of decreasing home prices. Importantly, it would reallocate money from private investment to public investment in affordable housing, for example.
- **Taxes:** Capital gains taxes could be both increased and deemed non-exempt. Taxes on second homes and investment property could also be taxed at a higher rate. This could dramatically decrease home prices and address wealth inequality. It would also function to allocate money from private investment to public investment.
- **Spending:** Government spending is currently limited to taxing the commercial circuit of money and borrowing through the bond issuance. In a system of sovereign money, a central bank could direct government spending at high-quality affordable housing.

5.2.2 Percent of Homes Purchased by Investors

Related to the discussion of home prices in Section 5.2.3 is the percent of homes that are purchased by investors for speculation and cash flow, rather than by individuals for residence. To consider the investment dynamic, I analyzed data from CoreLogic property

analytics firm[2]. The data defines an investor as buyers of homes that use corporate or non-individual identifier on the deed. Figures 5 and 6 discuss my findings.

Figure 5 shows the percent of homes purchased by investors by home price range from 1999-2018 across the United States. What is significant about the data is that, while overall investor home purchases have increased from 7% in 1999 to 11.3% in 2018, the percent of low-priced homes purchased by investors has increased from 10.9% to 20.2% between 199 and 2018. The percent of high-priced homes purchased by investors has stayed relatively steady, increasing from 6.0% in 1999 to 6.3% in 2018.

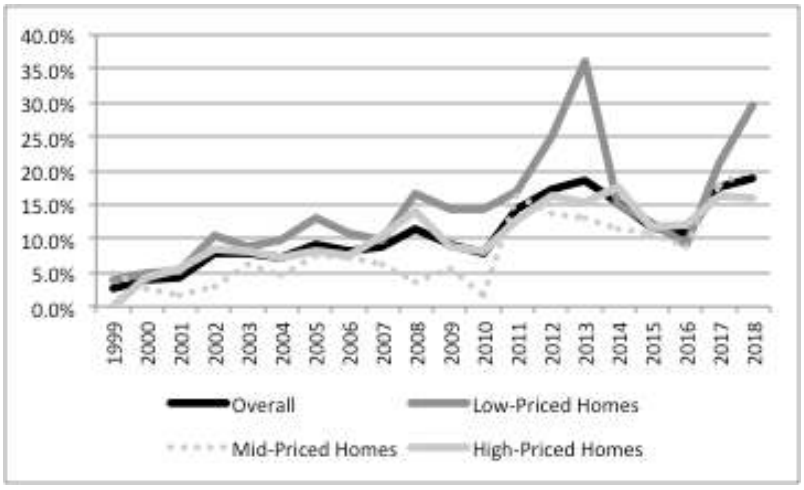
Percent of Homes Purchased by Investors, Nationwide

(Figure 5)

Figure 6 reveals a similar trend in Burlington, VT. In Burlington, overall investor home purchases have increased from only 2.7% in 1999 to 19% in 2018. But among low-

[2] Author calculations. Percent of homes purchased by investors data from Core Logic: https://www.corelogic.com/downloadable-docs/investor_data_final.xlsx

priced homes, investor purchases have increased from 3.8% to 29.5% in the last twenty years.



Percent of Homes Purchased by Investors, Burlington, VT

(Figure 6)

This section has shown that, increasingly, homes are being purchased by investors for rental income or a capital gain. This is especially true of low-priced homes that are traditionally purchased by first-time buyers, young families, or low-income families. This creates a situation in which wealth is increasingly concentrated with investors through rental payments and in the banking industry through mortgage profits.

A public bank could use tax, interest, and lending policy to address this concentration of wealth.

- **Interest:** Interest rates could be very high for investors and low, or even negative, for first-time homebuyers or young families.

- **Lending:** A central bank could place a qualitative stipulation on mortgage lending in which mortgages could only be issued for a primary residence.
- **Taxes:** Capital gains taxes could be both increased and deemed non-exempt. This could dramatically decrease home prices and address wealth inequality. It would also function to allocate money from private investment to public investment.

5.2.3 Banking Industry Income from Interest

Mortgages represent a very large portion of the credit-based money supply (Gaffney, 2009b). Banks earn money on the interest-rate spread between the reserves or deposits they borrow to maintain inter-bank liquidity and the loans they extend. To consider the impacts of the 2008 financial crisis on mortgage income, I analyzed mortgage income in the United Kingdom banking industry with respect to the cost of reserves and deposits, and the mortgage rate[3].

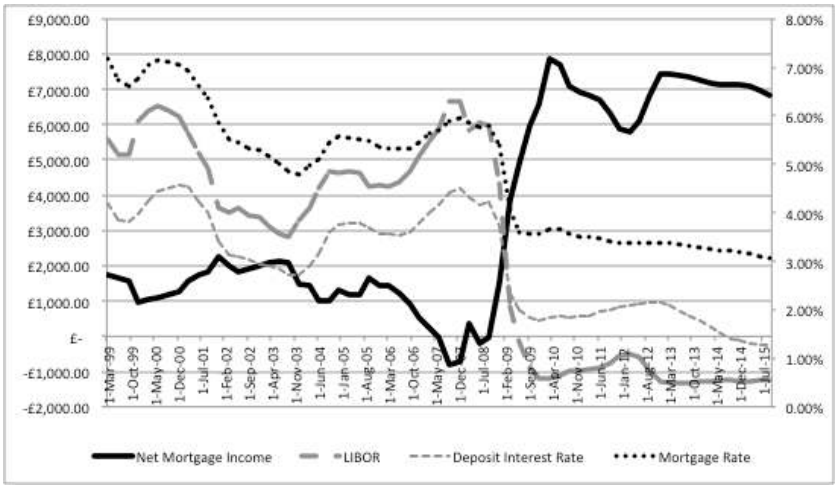
Figure 7 shows that mortgage income increased dramatically in the wake of the financial crisis. In fact, mortgage income had been steadily declining from 2001 until the financial crisis in late 2007 when mortgage income increased dramatically. This finding is interesting given the fact that the financial crisis was triggered by mortgage lending, i.e. why would mortgage income increase in the wake of a mortgage lending crisis?

By considering the interest rate on borrowed reserves, particularly LIBOR, Figure 7 partially reveals why mortgage income increased after the crisis. LIBOR is the rate at which banks lend reserves to one another in the overnight market. Until late 2007,

[3] Author calculations. Mortgage Income, LIBOR, Deposit Interest, and Mortgage Rate data from https://www.bankofengland.co.uk/statistics: Money and Credit Data, Narrow Money and Reserve Balances, Consumer Credit including Loans

LIBOR was higher than the rate banks pay for deposits. Accordingly, banks often use a portion of deposits to offset the reserves required to maintain liquidity in the interbank market when creating mortgages.

In 2008, in response to the financial crisis, central banks around the world flooded their banking systems with reserves at very low interest. This can be seen in Figure 7 when LIBOR drops below the Deposit Rate, and corresponds to a sharp uptick in Mortgage Income. Importantly, while LIBOR fell to unprecedented levels, hovering around .5% from 2009-2015, the market rate of mortgages fell only slightly. The spread between borrowed reserves (consisting almost fully of LIBOR) and offered mortgages increased dramatically and explains the increase in mortgage income.

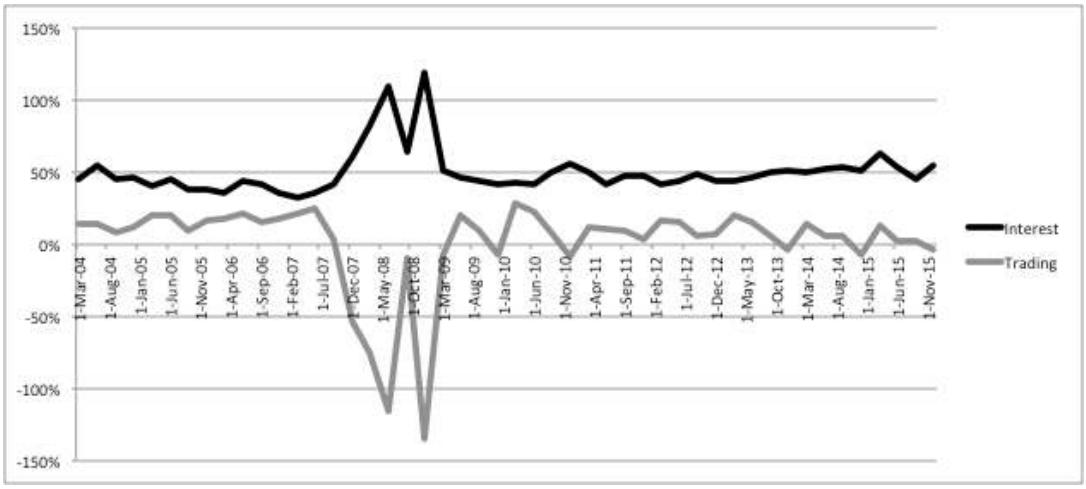


Mortgage Income in the UK Banking Industry

(Figure 7)

Figure 8 adds to the discussion above by analyzing the percent of income in the United Kingdom banking industry that is a result of interest on loans versus securities

trading. As Figure 7 shows, Mortgage Income had been dropping since the early 2000's. Accordingly, the UK banking industry began to securitize their mortgage portfolios. Figure 8 shows the financial losses that the UK banking industry suffered from 2007-2009 as a result of the heightened securitization. As a result of those losses, the Bank of England injected liquidity into the interbank market and the income—largely mortgage lending as seen in Figure 7—from interest increased to offset the losses due to trading.



Income Percent of Total Income in the UK Banking Industry

(Figure 8)

As discussed above, the sole tool for influencing the money supply at the disposal of modern central banks is the interest rate at which it lends reserves into the interbank market. When in response to the 2008 financial crisis, the Bank of England, along with banks around the world, flooded the market with reserves, the effect was to increase the income captured by the banking industry. A system of sovereign money would have four

policy levers at its disposal to both avert the crisis of 2008 and respond in a manner that is more just.

- **Spending:** Government spending could inject money directly into the economy in order to increase liquidity, rather than indirectly through the interest rate mechanism. Importantly, since the money supply would not be a function of bank profitability, the crisis would not have unfolded in the manner it did.
- **Interest:** Rather than an inefficacious tool to control the money supply, interest rates could be used to discriminate against the financial sector and provide credit to the productive economy.
- **Lending:** Since the money supply would not be a function of bank lending profitability, the central bank could lend into the economy for its goals.
- **Taxes:** A tax could be placed on financial transactions and asset repurchases for speculation. This would have the effect of averting crises in the future, but also of removing money from the financial sector and freeing up capacity for the government to spend on justice and sustainability.

5.3 Further Research

This section has discussed the potential of the central bank in a system of sovereign money to address justice using the four policy tools at its disposal. The potential to address issues of sustainability must also be considered. The following table (Figure 9) summarizes the analyses discussed in Section 5.2 and proposes five further analyses that

consider how a public bank could use creation and destruction policy to address issues of ecological importance. These include:

- Source and sink of Phosphorous flows in regional watersheds
- The value of stranded fossil fuel assets
- Total finance necessary for renewable energy transition
- Amount of credit directed to fossil fuel industry
- Percent of credit created for extractive industry

This is not an exhaustive list of analyses that could be considered from the lens of sovereign money. Such a monetary system has the potential to successfully address many of the problems we face today.

Interestingly, a sovereign money system has the potential to address our problems from two perspectives. On the one hand, a sovereign money system would create and destroy money in a manner that would not cause many of the social and ecological problems that the modern credit-based system of money does. On the other hand, as discussed above, a sovereign money system would be well-equipped with the tools necessary to address the problems that do arise as a function of a large and complex society. Figure 9 considers this dynamic.

	Applying four policy tools to social and ecological systems			
Summary of Conducted Analyses	Interest	Lending	Tax	Spending
Figure 3: Money Supply, Mortgage Debt, and Home Prices Figure 4: Central Bank Interest Rates and Home Prices	High rates for second homes or investment, low rates for first time buyers	Credit limited to primary residence	Capital gains non tax-exempt, higher taxes for investment and second homes	Spending to build or purchase high-quality, affordable housing, subsidies for housing based on family size and income
Figure 5: Percent of Homes Purcahsed by Investors, Nationwide	High rates for second homes or investment, low rates for first time buyers	Qualitative criteria for lending to real-estate investors	Capital gains non tax-exempt, higher taxes for investment and second homes	N/A
Figure 7: Mortgage Income in the UK Banking Industry	High rates for financial sector, low rates for productive sector (criteria for justice and sustainability)	Lend to productive economy, restrict lending to finance and speculation	Financial transaction tax and speculation tax assessed on asset repurcahses	Spending or citizen's income to inject money into productive economy
Further Research				
Source and Sink of Phosphorus Flows in Regional Watersheds	Low rates for farms with low phosphorus output; high interest rates for imported feed, fertilizer	Qualitative requirements for loans (farm size, fertilizer method, farm product)	Phosphorus import tax, phosphorus output tax	Price subsidy aimed at decreasing farm output, spending on phosphorus retention systems
Value of Stranded Fossil Fuel Assets	N/A	Eliminate loans for repurchases of fossil fuel assets; eliminate loans for continued fuel exploration	Tax on holding fossil fuel assets	Purchase fossil fuel assets and fossil fuel companies, and wind down operations
Total Finance Required for Renewable Energy Transition	Low or negative rates for startups, high rates for R&D to channel to public sector	Provide access to credit for R&D, clean energy startups, fossil fuel companies in transition	N/A	Spend on R&D, infrastructure, subsidies
Credit Directed to the Fossil Fuel Industry	N/A	Eliminate lending to fossil fuel extraction	Tax fossil fuel use and extraction, infrastructure, capital gains from assets	N/A
Percent of Credit Created for Extractive Industry	High interest for extractive, low interest for regenerative organizations	Limit lending to extractive industry to within threshold, accessible credit for restoration	Tax extraction, waste, and throughput beyond threshold	Spend on restoration, subsidize non-extractive industry

Four policy tools for influencing justice and sustainability per several studies.

(Figure 9)

6.0 Conclusion:

Returning full monetary prerogative to the state has the potential to address many of the social and environmental problems we face. This monetary prerogative includes not only the currency prerogative to determine the unit of account, but also the legal tender prerogative to issue credits into the economy and the seigniorage benefit of first use that comes with such creation.

These monetary prerogatives belong to the State as a function of money's nature as a social relation. Whereas they were once a function of the State's coercive power, full monetary prerogative should be returned to the State as a function of its democratic power. And since the state is obliged to maintain the stability of the unit of account it determines, restoring its ability to issue credits in that unit allows it to uphold that duty effectively.

The benefits of monetary prerogative, however, are only possible within a democratic society that prioritizes the goals of justice and sustainability. A system of sovereign money could just as effectively finance war and fossil fuel extraction as it does local agriculture and renewable energy. Similarly, the political influence of the financial sector is powerful (Mellor, 2009) and presents a challenge to monetary reform. As Bjerg writes that "if democracy is to mean anything…it must include the right of citizens to have an influence not only on how the government spends the money of the community but also on which kind of money should be circulating in the community" (Bjerg, 2014, p. 259 emphasis in original). Accordingly, while restoring the prerogative of money creation to the State ensures that a democratic process will inform how and what kind of money enters society, reform ultimately, rests upon the goals of society and a strong democratic process.

Importantly, transitioning control of the money supply to the central bank requires a change in theory. Since money is conceived in theory as a commodity, it is viewed, from a policy perspective, as something that should be solely connected to the market and commerce. As this paper has discussed, ecological monetary theory conceives of money as a social relation that shapes and informs value given the structure of its credit-debt

constitution. Accordingly, money should not be a function of commerce. Instead, the social and ecological relations that constitute money should provide the infrastructure for commerce.

The credit and debt relation within a sovereign money system, however, need not be conflated with commercial lending. Credit and debt can be viewed as alternate sides of a social and ecological relationship. In a system of sovereign public banking, the credits that a citizen holds may be seen simply as an obligation of the government to accept those credits in expiation of the debts it levies. This circle of credit and debt is radically different than bank borrowing and lending and can be seen as one in which the state and its citizens have simultaneous claims upon, and responsibilities to, the larger social contract. Public bank credit and debt relations can thus be viewed as equity in the commonwealth (Dyson and Hodgson, 2016) and can be extended to include non-humans and the ecosystems upon which we all depend.

Dittmer writes that such proposals for a more desirable alternative to the current monetary system are reminiscent of "evasive sloganeering" and are unlikely to deliver on their vision (Dittmer, 2015, p. 13). A monetary system whose goal is social and ecological equity will indeed falter in the context of modern extractive capitalist economies. What I think Dittmer misses, however, is that the "deep-rooted market ideology" (ibid) of modern economies is ultimately a function of the institutionalized social relations that surround the money creation process (Svartzman and Ament, 2019). Indeed, perhaps more than any other reform, monetary reform is capable of shifting the institutionalized social relations of our economic system and bringing money values into closer harmony with the social and ecological values of the world.

References:

Aglietta, M., 2018. Money: 5000 years of debt and power. Verso, London New York.

Alperovitz, G., 2012. Wall Street Is Too Big To Regulate. N. Y. Times.

Ament, J., 2019. An Ecological Monetary Theory. Ecol. Econ.

Bacchetta, P., 2018. The sovereign money initiative in Switzerland: an economic assessment. Swiss J. Econ. Stat. 154, 1–16. https://doi.org/10.1186/s41937-017-0010-y

Bacchetta, P., Perazzi, E., 2018. Sovereign Money Reforms and Welfare. IDEAS Work. Pap. Ser. RePEc.

Baldovin, F., Stella, A.L., 2007. Scaling and efficiency determine the irreversible evolution of a market. Proc. Natl. Acad. Sci. 104, 19741–19744. https://doi.org/10.1073/pnas.0706046104

Bean, C., Paustian, M., Penalver, A., Taylor, T., 2010. Monetary Policy After the Fall. Fed. Reserve Bank Kans. City 51.

Berentsen, A., Schar, F., 2018. The Case for Central Bank Electronic Money and the Non-case for Central Bank Cryptocurrencies [WWW Document]. https://doi.org/10.20955/r.2018.97-106

Bjerg, O., 2014. Making Money: The Philosophy of Crisis Capitalism. Verso, London ; New York.

Bregman, R., 2017. Utopia for Realists: How We Can Build the Ideal World. Little, Brown and Company, New York.

Brei, M., Schclarek, A., 2015. A theoretical model of bank lending: Does ownership matter in times of crisis? J. Bank. Finance 50, 298–307. https://doi.org/10.1016/j.jbankfin.2014.03.038

Brown, E., 2019. Banking on the People: Democratizing Money in the Digital Age. Democracy Collaborative.

Brown, E., 2013. The public bank solution: from austerity to prosperity / Ellen Hodgson Brown., First edition.. ed. Third Millennium Press, Baton Rouge, Louisiana.

Brown, E.H., Simpson, R., 2012. Web of Debt: The Shocking Truth about Our Money System and How We Can Break Free, 5th Revised ed. edition. ed. Third Millennium Press, Baton Rouge, La.

Cahen-Fourot, L., Lavoie, M., 2016. Ecological monetary economics: A post-Keynesian critique. Ecol. Econ. 126, 163–168. https://doi.org/10.1016/j.ecolecon.2016.03.007

Chen, H.-K., Liao, Y.-C., Lin, C.-Y., Yen, J.-F., 2018. The effect of the political connections of government bank CEOs on bank performance during the financial crisis. J. Financ. Stab. 36, 130–143. https://doi.org/10.1016/j.jfs.2018.02.010

Coleman, N., Feler, L., 2015. Bank ownership, lending, and local economic performance during the 2008–2009 financial crisis. J. Monet. Econ. 71, 50–66. https://doi.org/10.1016/j.jmoneco.2014.11.001

Daly, H., 2013a. A further critique of growth economics. Ecol. Econ., Transaction Costs and Environmental Policy 88, 20–24. https://doi.org/10.1016/j.ecolecon.2013.01.007

Daly, H., 2013b. Nationalize Money, Not Banks. CASSE. URL http://www.steadystate.org/nationalize-money-not-banks/ (accessed 5.18.17).

Daly, H., 1994. For the common good: redirecting the economy toward community, the environment, and a sustainable future / Herman E. Daly and John B. Cobb, Jr. ; with contributions by Clifford W. Cobb., 2nd ed., updated and expanded.. ed. Beacon Press, Boston.

Daly, H., 1992. Allocation, distribution, and scale: towards an economics that is efficient, just, and sustainable. Ecol. Econ. 6, 185–193. https://doi.org/10.1016/0921-8009(92)90024-M

Davies, G., 2002. A History of Money: From Ancient Times to the Present Day, 3rd edition. ed. University of Wales Press, Cardiff.

De Rosa, L., 2007. The Beginnings of Paper Money Circulation: the Neapolitan Public Banks (1540-1650). J. Eur. Econ. Hist. Rome 36, 261–281.

Denning, S., 2013. Big Banks and Derivatives: Why Another Financial Crisis Is Inevitable [WWW Document]. Forbes. URL https://www.forbes.com/sites/stevedenning/2013/01/08/five-years-after-the-financial-meltdown-the-water-is-still-full-of-big-sharks/#2a7ffc0e3a41 (accessed 9.2.19).

Dittmer, K., 2015. 100 percent reserve banking: A critical review of green perspectives. Ecol. Econ. 109, 9–16. https://doi.org/10.1016/j.ecolecon.2014.11.006

Douthwaite, R., 1999. The Ecology of Money. UIT Cambridge Ltd., Totnes, Devon, Eng. : Bristol, [Eng.] : [White River Junction, Vt.].

Duprey, T., 2013. Bank Ownership and Credit Cycle: the lower sensitivity of public bank lending to the business cycle. IDEAS Work. Pap. Ser. RePEc.

Dyson, B., Greenham, T., Ryan-Collins, J., Werner, R., 2011. Towards a Twenty-First Century Banking and Monetary System, Submision to the Independent Commission on Banking. Independent Commission on Banking, London, UK.

Dyson, B., Hodgson, G., 2016. Accounting for Sovereign Money: Why State-Issued Money is Not "Debt." Positive Money, London.

Dyson, B., Jackson, A., Hodgson, G., 2014. Creating a Sovereign Monetary System. Positive Money, London.

Farley, J., Burke, M., Flomenhoft, G., Kelly, B., Murray, D., Posner, S., Putnam, M., Scanlan, A., Witham, A., 2013. Monetary and Fiscal Policies for a Finite Planet. Sustainability 5, 2802–2826. https://doi.org/10.3390/su5062802

Farley, J., Schmitt, A., Burke, M., Farr, M., 2015. Extending market allocation to ecosystem services: Moral and practical implications on a full and unequal planet. Ecol. Econ. 117, 244–252. https://doi.org/10.1016/j.ecolecon.2014.06.021

Fettig, D., 2002. Lender of More Than Last Resort | Federal Reserve Bank of Minneapolis. Federal Reserve Bank of Minneapolis.

Fisher, I., 1936. 100% Money and the Public Debt. Economic Forum.

Flood, M., Lipton, A., Quintana, D., Serguieva, A., 2018. Guest Editorial Special Issue on Complex Systems in Finance and Economics. IEEE Syst. J. 12, 1087–1089. https://doi.org/10.1109/JSYST.2018.2817978

Francis, B., Hasan, I., Wang, H., 2014. Banking deregulation, consolidation, and corporate cash holdings: U.S. evidence. J. Bank. Finance 41, 45–56. https://doi.org/10.1016/j.jbankfin.2013.12.018

Friedman, M., 1960. A program for monetary stability., Moorhouse I. X. Millar lecture series ; no. 3. Fordham University Press, New York.

Fullerton, J., 2011. The Big Choice. Cap. Inst. Future Finance Blog. URL http://capitalinstitute.org/blog/big-choice-0/

Gaffney, M., 2009a. The Role of Land Markets in Economic Crises. Am. J. Econ. Sociol. 68, 855–888.

Gaffney, M., 2009b. 3 Money, credit, and crisis.(Report). Am. J. Econ. Sociol. 68, 983.

Graeber, D., 2014. Debt: The First 5,000 Years, Upd Exp edition. ed. Melville House, Brooklyn.

Hakenes, H., Schnabel, I., 2006. The Threat of Capital Drain: A Rationale for Public Banks? (SSRN Scholarly Paper No. ID 906993). Social Science Research Network, Rochester, NY.

Hanna, T.M., 2018. Our Common Wealth: The return of public ownership in the United States, 1 edition. ed. Manchester University Press, Manchester.

Hardmeyer, E., 2012. Bank of North Dakota Annual Report: President's Message. Bank of North Dakota.

Hodgson, G., 2013. Banking, Finance and Income Inequality. Positive Money, London.

Huber, J., 2016. Sovereign Money: Beyond Reserve Banking, 1st ed. 2017 edition. ed. Palgrave Macmillan, Cham.

Huber, J., 2014. Modern Money Theory and New Currency Theory. Comp. Discuss. Real-World Econ. Rev. 38–57.

Huber, J., Robertson, J., 2000. Creating New Money. New Economics Foundation, London.

Hudson, M., 2015. Killing the Host: How Financial Parasites and Debt Bondage Destroy the Global Economy. ISLET.

Hudson, M., 2010. The Transition from Industrial Capitalism to a Financialized Bubble Economy | Levy Economics Institute (No. 627). Levy Economics Institute of Bard College.

Ingham, G., 2004. The Nature of Money, 1 edition. ed. Polity, Cambridge, UK ; Malden, MA.

Jackson, A., 2013. The Chicago Plan & Positive Money's proposals - What is the difference? Posit. Money. URL https://positivemoney.org/2013/01/the-chicago-plan-versus-positive-money/ (accessed 7.19.19).

Jackson, A., Dyson, B., 2012. Modernising Money: Why Our Monetary System is Broken and How it Can be Fixed. Positive Money, London.

Jackson, T., Victor, P.A., 2015. Does credit create a 'growth imperative'? A quasi-stationary economy with interest-bearing debt. Ecol. Econ. 120, 32–48. https://doi.org/10.1016/j.ecolecon.2015.09.009

Kennedy, M., 2012. Occupy Money: Creating an Economy Where Everybody Wins. New Society Publishers, Gabriola Islands.

Kiff, J., JKiff@imf.org, Elliott, J.A., JElliott@imf.org, Kazarian, E.G., EKazarian@imf.org, Scarlata, J.G., JScarlata@imf.org, Spackman, C.,

CSpackman@imf.org, 2009. Credit Derivatives: Systemic Risks and Policy Options? IMF Work. Pap. 09, 1. https://doi.org/10.5089/9781451874006.001

Lapavitsas, C., 2013. Profiting without producing: how finance exploits us all / Costas Lapavitsas. Verso, London ; New York.

Lapavitsas, C., 2010. Systemic Failure of Private Banking: A Case for Public Banks, in: Arestis, P., Sawyer, M. (Eds.), 21st Century Keynesian Economics, International Papers in Political Economy Series. Palgrave Macmillan UK, London, pp. 162–201. https://doi.org/10.1057/9780230285415_5

Lietaer, B., Arnsperger, C., Goerner, S., Brunnhuber, S., 2012. Money and Sustainability: The Missing Link. Triarchy Press Ltd.

Mankiw, N.G., 2013. Macroeconomics / N. Gregory Mankiw., 8th ed.. ed. Worth, New York, NY.

Mann, M., 1986. The sources of social power / Michael Mann. Cambridge University Press, Cambridge [England].

Mazzucato, M., 2018. The Value of Everything: Making and Taking in the Global Economy. PublicAffairs, New York.

Mcmahon, M., 1997. From the ground up: ecofeminism and ecological economics. Ecol. Econ. 20, 163–173.

Mellor, M., 2015. Debt or Democracy: Public Money for Sustainability and Social Justice. Pluto Press.

Mellor, M., 2010. The Future of Money: From Financial Crisis to Public Resource. Pluto Press, London ; New York : New York.

Mellor, M., 2009. Ecofeminist Political Economy and the Politics of Money, in: Salleh, A. (Ed.), Eco-Sufficiency and Global Justice: Women Write Political Ecology. Pluto Press, London ; New York, NY : North Melbourne, Vic. : New York, NY.

Michel, A., Hudon, M., 2015. Community currencies and sustainable development: A systematic review. Ecol. Econ. 116, 160.

Minsky, H., 1977. The Financial Instability Hypothesis: An Interpretation of Keynes and an Alternative to Standard Theory. Challenge 20, 20–27. https://doi.org/10.1080/05775132.1977.11470296

Nielsen‐Pincus, M., Moseley, C., 2013. The Economic and Employment Impacts of Forest and Watershed Restoration. Restor. Ecol. 21, 207‐214. https://doi.org/10.1111/j.1526-100X.2012.00885.x

Ogura, Y., 2018. The objective function of government-controlled banks in a financial crisis. J. Bank. Finance 89, 78–93. https://doi.org/10.1016/j.jbankfin.2018.01.015

Piketty, T., 2014. Capital in the Twenty First Century. Belknap Press: An Imprint of Harvard University Press, Cambridge Massachusetts.

Rezende, F., 2015. Why Does Brazil's Banking Sector Need Public Banks? What Should BNDES Do? (SSRN Scholarly Paper No. ID 3102138). Social Science Research Network, Rochester, NY.

Roberds, W., Velde, F.R., 2014. Early Public Banks (SSRN Scholarly Paper No. ID 2399046). Social Science Research Network, Rochester, NY.

Robertson, J., 2012. Future money: breakdown or breakthrough? Green Books, Totnes.

Ruml, B., 1946. Taxes For Revenue Are Obsolete. Am. Aff. VIII, 35–39.

Ryan-Collins, J., Greenham, T., Werner, R., Jackson, A., 2012. Where Does Money Come From?: A Guide to the UK Monetary & Banking System, 2nd edition. ed. New Economics Foundation, London.

Ryan-Collins, J., Lloyd, T., Macfarlane, L., 2017. Rethinking the Economics of Land and Housing. Zed Books, London.

Samuelson, P., 1948. Economics: The Original 1948 Edition, 1 edition. ed. McGraw-Hill Education, New York.

Scheffer, M., Carpenter, S.R., Lenton, T.M., Bascompte, J., Brock, W., Dakos, V., van de Koppel, J., van de Leemput, I.A., Levin, S.A., van Nes, E.H., Pascual, M., Vandermeer, J., 2012. Anticipating Critical Transitions. Science 338, 344–348.

Shen, C.-H., Lin, C.-Y., 2012. Why government banks underperform: A political interference view. J. Financ. Intermediation 21, 181–202. https://doi.org/10.1016/j.jfi.2011.06.003

Simons, H.C., 1948. Economic Policy for a Free Society. University of Chicago Press, Chicago, IL.

Smith, S., 2017. The Economist's Tale : How Technology Enables a National Income, the End of Income Taxes, and a Balanced Budget [WWW Document]. URL https://www.ebay.com/itm/The-Economists-Tale-How-Technology-Enables-a-National-Income-the-End-of-/143019576629 (accessed 9.3.19).

Soddy, F., 2012. Cartesian Economics: The Bearing of Physical Science Upon State Stewardship. Cosimo Classics, New York, N.Y.

Soddy, F., 1930. Wealth, Virtual Wealth and Debt The Solution of the Economic Paradox. Omni.

Spencer, P., Perkins, P.E., Erickson, J.D., 2018. Re-establishing Justice as a Pillar of Ecological Economics Through Feminist Perspectives. Ecol. Econ. 152, 191–198. https://doi.org/10.1016/j.ecolecon.2018.05.022

Svartzman, R., Ament, J., 2019. Money, interest rates, and accumulation on a finite planet: revisiting the 'monetary growth imperative' through institutionalist approaches, in: A Research Agenda for Ecological Economics. Edward Elgar.

Svartzman, R., Dron, D., Espagne, E., 2019. From ecological macroeconomics to a theory of endogenous money for a finite planet. Ecol. Econ. 162, 108–120. https://doi.org/10.1016/j.ecolecon.2019.04.018

Timberlake, R., 1978. The origins of central banking in the United States / Richard H. Timberlake, Jr. Harvard University Press, Cambridge, Mass.

Tolle, M., 2016. Central bank digital currency: the end of monetary policy as we know it? Bank Undergr. URL https://bankunderground.co.uk/2016/07/25/central-bank-digital-currency-the-end-of-monetary-policy-as-we-know-it/ (accessed 9.3.19).

Velde, F., 2018. The Neapolitan Banks in the Context of Early Modern Public Banks. https://doi.org/10.13140/RG.2.2.11171.76327

Villar, L., Briozzo, A., Pesce, G., Fernandez, A., 2016. El rol de la banca publica en el financiamiento a pymes. Estudio comparativo para la Argentina y Brasil. (The Role of Public Banks in Financing SMEs: Comparative Study for Argentina and Brazil. With English summary.). Desarro. Soc. 205–241.

Werner, R., 2011. ECONOMICS AS IF BANKS MATTERED: A CONTRIBUTION BASED ON THE INDUCTIVE METHODOLOGY. Manch. Sch. 79, 25–35. https://doi.org/10.1111/j.1467-9957.2011.02265_5.x

Wironen, M.B., Bennett, E.M., Erickson, J.D., 2018. Phosphorus flows and legacy accumulation in an animal-dominated agricultural region from 1925 to 2012. Glob. Environ. Change 50, 88–99. https://doi.org/10.1016/j.gloenvcha.2018.02.017

Wray, L.R., 2015. Modern Money Theory: A Primer on Macroeconomics for Sovereign Monetary Systems, 2 edition. ed. Palgrave Macmillan, Houndmills, Basingstoke, Hampshire ; New York, NY.

Yeyati, E.L., Micco, A., Panizza, U., 2007. A Reappraisal of State-Owned Banks. Econ. J. Lat. Am. Caribb. Econ. Assoc. 7, 209–47, 256–59.

Conclusion:

This dissertation has filled a major theoretical gap in ecological economics by developing a comprehensive theory of money. It did this by framing an ecological monetary theory, developing an ecological monetary theory, and finally, applying ecological monetary theory to a monetary reform proposal.

This dissertation has made the argument that the ontological presuppositions of the Western philosophical tradition yield a neoclassical economic theory in which money must be conceived of as a neutral commodity medium that facilitates barter. Ecological monetary theory, however, reveals that barter has never existed as a mode of economic exchange, and, accordingly, that money's nature lies in the unit of account.

This dissertation has argued that the incorrect orthodox conception of money is ultimately a function of the causal arrow of value that is rooted in an ontology of dualism. Accordingly, it has argued that the problems of the modern money system are not a function of modern money's existence as debt but rather in the ontological presuppositions that acquiesce the prerogatives of money creation and seigniorage to the private sector. Since theory has such profound impacts on policy, developing monetary systems that are aligned with the goals of ecological economics requires an alternative theory that is rooted in an ontology of embeddedness.

By rooting ecological monetary theory in such an ontology, it is capable of addressing the contradiction between the fact that money is at once an abstract social relation and a tangible claimant of biophysical resources in a way that few other theories are able. It is for this reason that ecological monetary theory has the potential to be incredibly useful for ecological economics in the future.

The third chapter of this dissertation explored how ecological monetary theory can be used to inform a system of public banking money in which credit-based money is viewed as equity in the commonwealth. Beyond sovereign money, however, ecological monetary theory can be used to consider complementary, alternative, and crypto currencies, as well as local public banks that exist within the current monetary system and central bank digital currencies coexisting with bank money. These systems could be judged according to an "if/but" criteria in which the proposal is deemed desirable *if* they incorporate certain criteria that move the system toward social and environmental goals, *but* are limited in their efficacy given the larger money system.

Further research should also apply ecological monetary theory to current debates in ecological economics. These include the monetary growth imperative, the efficacy of full reserve banking, and the effectiveness of green finance. For example, Jackson and Victor's (2015) consideration of the monetary growth imperative could be extended to include both wealth distribution and resource throughput. This would allow ecological economics to understand their stance that interest-bearing debt does not create a growth imperative in light of social and ecological equity.

While ecological monetary theory is a useful tool for considering monetary proposals and critiques, its most powerful use might be in designing alternative monetary systems. In this capacity, the theory can be used as a framework for outlining the characteristics that a system must embody in order to be considered desirable vis-à-vis justice and sustainability

Ecological monetary theory is also useful for addressing issues external to our field. These include monetary topics such as Modern Money Theory and New Currency

Theory, but also political proposals such as the Green New Deal. For example, regarding the Green New Deal, ecological monetary theory may be used to frame a conversation about the importance of addressing the money creation system in our discussion of funding the proposal. Similarly, it may highlight the central role of the modern banking system in creating many of the problems that the Green New Deal attempts to address. Finally, it may discuss the proposal's limitations from the perspective of banking policy or monetary regulation.

While this dissertation has created the first comprehensive monetary theory for ecological economics, the goal of this dissertation included that the theory also be broadly accepted. Ecological monetary theory should, accordingly, continue to be critiqued and improved upon. This theory is meant to be a first attempt at a theory for the field and not a definitive and immutable approach. Part of the problem this dissertation has addressed is the fact that orthodox monetary theory has not been updated to reflect new discoveries and theories in the natural or social sciences. Ecological monetary theory should, thus, be continually critiqued and updated in light of new work in order that it evolve with science.

This dissertation is a novel contribution to the field of ecological economics. While monetary theory is not capable of addressing all of the world problems, the modern money system is surely a major source of many of the problems we currently face. The theory contained within this dissertation can therefore inform the manner in which our field addresses those problems.

Bibliography:

Aglietta, M., 2018. Money: 5000 years of debt and power. Verso, London New York.

Alexander, D., Blum, V., 2016. Ecological economics: A Luhmannian analysis of integrated reporting. Ecological Economics 129, 241–251. https://doi.org/10.1016/j.ecolecon.2016.06.020

Alperovitz, G., 2012. Wall Street Is Too Big To Regulate. N. Y. Times.

Ament, J., 2019. An Ecological Monetary Theory. Ecol. Econ.

Ament, J., 2019. Toward an Ecological Monetary Theory. Sustainability 11, 923. https://doi.org/10.3390/su11030923

Ayres, R.U., 1998. Eco-thermodynamics: economics and the second law. Ecological Economics 26, 189–209. https://doi.org/10.1016/S0921-8009(97)00101-8

Bacchetta, P., 2018. The sovereign money initiative in Switzerland: an economic assessment. Swiss J. Econ. Stat. 154, 1–16. https://doi.org/10.1186/s41937-017-0010-y

Bacchetta, P., Perazzi, E., 2018. Sovereign Money Reforms and Welfare. IDEAS Work. Pap. Ser. RePEc.

Baldovin, F., Stella, A.L., 2007. Scaling and efficiency determine the irreversible evolution of a market. Proc. Natl. Acad. Sci. 104, 19741–19744. https://doi.org/10.1073/pnas.0706046104

Barwell, R., 2016. Macroeconomic policy after the crash: issues in monetary and fiscal policy / Richard Barwell. Palgrave Macmillan, London.

Bean, C., Paustian, M., Penalver, A., Taylor, T., 2010. Monetary Policy After the Fall. Fed. Reserve Bank Kans. City 51.

Beauvoir, S. de, 1968. The Second Sex, 1 edition. ed. Random House, New York.

Berentsen, A., Schar, F., 2018. The Case for Central Bank Electronic Money and the Non-case for Central Bank Cryptocurrencies [WWW Document]. https://doi.org/10.20955/r.2018.97-106

Binswanger, M., 2009. Is there a growth imperative in capitalist economies? a circular flow perspective. Journal of Post Keynesian Economics 31, 707–727. https://doi.org/10.2753/PKE0160-3477310410

Bjerg, O., 2014. Making Money: The Philosophy of Crisis Capitalism. Verso, London ; New York.

Bjerg, O., 2016. How is Bitcoin Money? Theory, Culture & Society 33, 53–72. https://doi.org/10.1177/0263276415619015

Bordo, S., 1986. The Cartesian Masculinization of Thought. Signs 11, 439–456.

Boulding, B., 1981. Evolutionary economics / Kenneth E. Boulding. Sage publications, London.

Bregman, R., 2017. Utopia for Realists: How We Can Build the Ideal World. Little, Brown and Company, New York.

Brei, M., Schclarek, A., 2015. A theoretical model of bank lending: Does ownership matter in times of crisis? J. Bank. Finance 50, 298–307. https://doi.org/10.1016/j.jbankfin.2014.03.038

Brennan, T., 1997. Economy for the Earth: The labour theory of value without the subject/object distinction. Ecological Economics 175–185.

Brown, E., 2013. The public bank solution: from austerity to prosperity / Ellen Hodgson Brown., First edition.. ed. Third Millennium Press, Baton Rouge, Louisiana.

Brown, E., 2019. Banking on the People: Democratizing Money in the Digital Age. Democracy Collaborative.

Brown, E.H., Simpson, R., 2012. Web of Debt: The Shocking Truth about Our Money System and How We Can Break Free, 5th Revised ed. edition. ed. Third Millennium Press, Baton Rouge, La.

Brown, P., 2013. Democracy in the Anthropocene. Center for Humans & Nature. URL http://www.humansandnature.org/democracy-peter-g.-brown (accessed 12.7.16).

Brown, P., Garver, G., Helmuth, K., Howell, R., 2009. Right Relationship: Building a Whole Earth Economy, 1 edition. ed. Berrett-Koehler Publishers, San Francisco.

Brown, P.G., 1998. Toward an economics of stewardship: the case of climate. Ecological Economics 26, 11–21.

Cahen-Fourot, L., Lavoie, M., 2016. Ecological monetary economics: A post-Keynesian critique. Ecol. Econ. 126, 163–168. https://doi.org/10.1016/j.ecolecon.2016.03.007

Campiglio, E., 2016. Beyond carbon pricing: The role of banking and monetary policy in financing the transition to a low-carbon economy. Ecological Economics 121, 220–230. https://doi.org/10.1016/j.ecolecon.2015.03.020

Chapman, A., 1980. Barter as a Universal Mode of Exchange. L'Homme 20, 33–83.

Chen, H.-K., Liao, Y.-C., Lin, C.-Y., Yen, J.-F., 2018. The effect of the political connections of government bank CEOs on bank performance during the financial crisis. J. Financ. Stab. 36, 130–143. https://doi.org/10.1016/j.jfs.2018.02.010

Chick, V., Dow, 1992. On Money, Method and Keynes: Selected Essays. Palgrave Macmillan, New York, N.Y.

Cirillo, R., 1986. Leon Walras' Theory of Money. The American Journal of Economics and Sociology 45, 215–221.

Coleman, N., Feler, L., 2015. Bank ownership, lending, and local economic performance during the 2008–2009 financial crisis. J. Monet. Econ. 71, 50–66. https://doi.org/10.1016/j.jmoneco.2014.11.001

Corner, E.J.H., 1949. The Durian Theory or the Origin of the Modern Tree. Annals of Botany 13, 367–414.

Daly, H., 1974. Steady-State Economics versus Growthmania: A Critique of the Orthodox Conceptions of Growth, Wants, Scarcity, and Efficiency. Policy Sciences 5, 149–167.

Daly, H., 1977. Steady-state economics : the economics of biophysical equilibrium and moral growth / Herman E. Daly.

Daly, H., 1992. Allocation, distribution, and scale: towards an economics that is efficient, just, and sustainable. Ecol. Econ. 6, 185–193. https://doi.org/10.1016/0921-8009(92)90024-M

Daly, H., 1994. For the common good: redirecting the economy toward community, the environment, and a sustainable future / Herman E. Daly and John B. Cobb, Jr. ; with contributions by Clifford W. Cobb., 2nd ed., updated and expanded.. ed. Beacon Press, Boston.

Daly, H., 2013. Nationalize Money, Not Banks. CASSE. URL http://www.steadystate.org/nationalize-money-not-banks/ (accessed 5.18.17).

Daly, H., 2013a. A further critique of growth economics. Ecol. Econ., Transaction Costs and Environmental Policy 88, 20–24. https://doi.org/10.1016/j.ecolecon.2013.01.007

Davies, G., 2002. A History of Money: From Ancient Times to the Present Day, 3rd edition. ed. University of Wales Press, Cardiff.

De Rosa, L., 2007. The Beginnings of Paper Money Circulation: the Neapolitan Public Banks (1540-1650). J. Eur. Econ. Hist. Rome 36, 261–281.

Denning, S., 2013. Big Banks and Derivatives: Why Another Financial Crisis Is Inevitable [WWW Document]. Forbes. URL https://www.forbes.com/sites/stevedenning/2013/01/08/five-years-after-the-financial-meltdown-the-water-is-still-full-of-big-sharks/#2a7ffc0e3a41 (accessed 9.2.19).

Di Muzio, T., Robbins, R.H., 2017. An Anthropology of Money: A Critical Introduction, 1 edition. ed. Routledge, New York.

Dittmer, K., 2013. Local currencies for purposive degrowth? A quality check of some proposals for changing money-as-usual. Journal of Cleaner Production 54, 3.

Dittmer, K., 2015. 100 percent reserve banking: A critical review of green perspectives. Ecol. Econ. 109, 9–16. https://doi.org/10.1016/j.ecolecon.2014.11.006

Dittmer, K., 2017. Communal Currencies. Latin American Perspectives 44, 94–110. https://doi.org/10.1177/0094582X16658256

Dodd, N., 1994. The Sociology of Money: Economics, Reason & Contemporary Society, 1St Edition edition. ed. Continuum Intl Pub Group, New York.

Donovan, J., 1993. Animal Rights and Feminist Theory, in: Gaard, G. (Ed.), Ecofeminism: Women, Animals, Nature: 1st (First) Edition. Temple University Press.

Douai, A., 2009. Value Theory in Ecological Economics: The Contribution of a Political Economy of Wealth. Environmental Values 18, 257–284.

Douthwaite, R., 1999. The Ecology of Money. UIT Cambridge Ltd., Totnes, Devon, Eng. : Bristol, [Eng.] : [White River Junction, Vt.].

Duprey, T., 2013. Bank Ownership and Credit Cycle: the lower sensitivity of public bank lending to the business cycle. IDEAS Work. Pap. Ser. RePEc.

Dyson, B., Greenham, T., Ryan-Collins, J., Werner, R., 2011. Towards a Twenty-First Century Banking and Monetary System, Submision to the Independent Commission on Banking. Independent Commission on Banking, London, UK.

Dyson, B., Hodgson, G., 2016. Accounting for Sovereign Money: Why State-Issued Money is Not “Debt.” Positive Money, London.

Dyson, B., Jackson, A., Hodgson, G., 2014. Creating a Sovereign Monetary System. Positive Money, London.

Erickson, J., Brown, P., 2016. How Higher Education Imperils the Future: An Urgent Call for Action. Balance: Club of Rome Magazine 1, 8.

Farley, J., 2010. Conservation Through the Economics Lens. Environmental Management 45, 26–38. https://doi.org/10.1007/s00267-008-9232-1

Farley, J., Burke, M., Flomenhoft, G., Kelly, B., Murray, D., Posner, S., Putnam, M., Scanlan, A., Witham, A., 2013. Monetary and Fiscal Policies for a Finite Planet. Sustainability 5, 2802–2826. https://doi.org/10.3390/su5062802

Farley, J., Daly, H., 2011. Ecological Economics, Second Edition. Island Press.

Farley, J., Schmitt, A., Burke, M., Farr, M., 2015. Extending market allocation to ecosystem services: Moral and practical implications on a full and unequal planet. Ecol. Econ. 117, 244–252. https://doi.org/10.1016/j.ecolecon.2014.06.021

Fayazmanesh, S., 2012. Money and Exchange: Folktales and Reality, 1 edition. ed. Routledge, London.

Fettig, D., 2002. Lender of More Than Last Resort | Federal Reserve Bank of Minneapolis. Federal Reserve Bank of Minneapolis.

Fisher, I., 1936. 100% Money and the Public Debt. Economic Forum.

Flood, M., Lipton, A., Quintana, D., Serguieva, A., 2018. Guest Editorial Special Issue on Complex Systems in Finance and Economics. IEEE Syst. J. 12, 1087–1089. https://doi.org/10.1109/JSYST.2018.2817978

Fontana, G., Sawyer, M., 2016. Full Reserve Banking: More 'Cranks' Than 'Brave Heretics.' Cambridge Journal of Economics 40, 1333–1350. https://doi.org/10.1093/cje/bew016

Fontana, G., Sawyer, M., 2016b. Towards post-Keynesian ecological macroeconomics. Ecological Economics 121, 186–195. https://doi.org/10.1016/j.ecolecon.2015.03.017

Foster, J.B., York, R., Clark, B., 2011. The Ecological Rift: Capitalism's War on the Earth. Monthly Review Press, New York.

Francis, B., Hasan, I., Wang, H., 2014. Banking deregulation, consolidation, and corporate cash holdings: U.S. evidence. J. Bank. Finance 41, 45–56. https://doi.org/10.1016/j.jbankfin.2013.12.018

Friedman, M., 1949. The Marshallian Demand Curve. Journal of Political Economy 57, 463–495. https://doi.org/10.1086/256879

Friedman, M., 1960. A program for monetary stability., Moorhouse I. X. Millar lecture series ; no. 3. Fordham University Press, New York.

Fullerton, J., 2011. The Big Choice. Cap. Inst. Future Finance Blog. URL http://capitalinstitute.org/blog/big-choice-0/

Gaard, G., 1993. Ecofeminism : women, animals, nature / edited by Greta Gaard. Temple University Press.

Gaard, G., Gruen, L., 1993. Ecofeminism: Toward global justice and planetary health. Society and Nature.

Gaffney, M., 2009a. The Role of Land Markets in Economic Crises. Am. J. Econ. Sociol. 68, 855–888.

Gaffney, M., 2009b. 3 Money, credit, and crisis.(Report). Am. J. Econ. Sociol. 68, 983.

Galbraith, J.K., 1975. Money: Whence It Came, Where It Went. Houghton Mifflin, Boston.

Gardiner, G., 2004. The primacy of trade debts in the development of money, in: Wray, L.R. (Ed.), Credit and State Theories of Money: The Contributions of A. Mitchell Innes. Edward Elgar Pub, Cheltenham, UK ; Northampton, MA, USA.

Gendron, C., 2014. Beyond environmental and ecological economics: Proposal for an economic sociology of the environment. Ecological Economics 105, 240–253. https://doi.org/10.1016/j.ecolecon.2014.06.012

Georgescu-Roegen, N., 1975. Energy and Economic Myths. Southern Economic Journal 41, 347–381. https://doi.org/10.2307/1056148

Gesell, S., 1929. Establishing a Natural Economic Order Through Free-Land and Free-Money by Silvio Gesell: A Founder of the 1919 Bavarian Soviet Republic. The Edwin Mellen Press.

Gintis, H., 2000. Beyond Homo economicus: evidence from experimental economics. Ecological Economics 35, 311–322.

Gowdy, J., 2009. Microeconomic Theory Old and New: A Student's Guide. Stanford University Press.

Gowdy, J., Erickson, J.D., 2005. The approach of ecological economics. Camb. J. Econ. 29, 207–222. https://doi.org/10.1093/cje/bei033

Gowdy, J., Krall, L., 2013. The ultrasocial origin of the Anthropocene. Ecological Economics 95, 137–147. https://doi.org/10.1016/j.ecolecon.2013.08.006

Graeber, D., 2014. Debt: The First 5,000 Years, Upd Exp edition. ed. Melville House, Brooklyn.

Graziani, A., 1989. The Theory of the Monetary Circuit. Thames Papers in Political Economy 1–26.

Grierson, P., 1977. The origins of money. Athlone Press.

Hahn, F., 1981. Money and Inflation. Basil Blackwell Publisher, England.

Hakenes, H., Schnabel, I., 2006. The Threat of Capital Drain: A Rationale for Public Banks? (SSRN Scholarly Paper No. ID 906993). Social Science Research Network, Rochester, NY.

Hanna, T.M., 2018. Our Common Wealth: The return of public ownership in the United States, 1 edition. ed. Manchester University Press, Manchester.

Hardmeyer, E., 2012. Bank of North Dakota Annual Report: President's Message. Bank of North Dakota.

Harvey, D., 2015. Seventeen Contradictions and the End of Capitalism, Reprint edition. ed. Oxford University Press, Oxford.

Haselgrove, C., Krmnicek, S., 2012. The Archaeology of Money. Annual Review of Anthropology 41, 235–250. https://doi.org/10.1146/annurev-anthro-092611-145716

Hayek, F.A. von, 1935. Prices and production., 2d, rev. and enl. ed.. ed, Studies in economics and political science, no. 107. GRoutledge & Sons, ltd, London.

Henry, J., 2004. The Social Origins of Money: The Case of Egypt, in: Wray, L.R., Innes, A.M. (Eds.), Credit and State Theories of Money: The Contributions of A. Mitchell Innes. Edward Elgar Pub, Cheltenham, UK ; Northampton, MA, USA.

Hicks, J.R., 1937. Mr. Keynes and the "Classics"; A Suggested Interpretation. Econometrica 5, 147. https://doi.org/10.2307/1907242

Hodgson, G., 2013. Banking, Finance and Income Inequality. Positive Money, London.

Huber, J., 2014. Modern Money Theory and New Currency Theory. A Comparative Discussion, real-world economics review 38–57.

Huber, J., 2016. Sovereign Money: Beyond Reserve Banking, 1st ed. 2017 edition. ed. Palgrave Macmillan, Cham.

Huber, J., Robertson, J., 2000. Creating New Money. New Economics Foundation, London.

Hudson, M., 2004. The Archaeology of Money: Debt vs. Barter Theories of Money's Origins, in: Wray, L.R., Innes, A.M. (Eds.), Credit and State Theories of Money:

The Contributions of A. Mitchell Innes. Edward Elgar Pub, Cheltenham, UK ; Northampton, MA, USA.

Hudson, M., 2010. The Transition from Industrial Capitalism to a Financialized Bubble Economy | Levy Economics Institute (No. 627). Levy Economics Institute of Bard College.

Hudson, M., 2015. Killing the Host: How Financial Parasites and Debt Bondage Destroy the Global Economy. ISLET.

Humphrey, C., 1985. Barter and Economic Disintegration. Man 20, 48–72. https://doi.org/10.2307/2802221

Ims, K.J., Jakobsen, O.D., Zsolnai, L., 2015. Product as process — Commodities in mechanic and organic ontology. Ecological Economics 110, 11–14. https://doi.org/10.1016/j.ecolecon.2014.12.023

Ingham, G., 1996. Money is a Social Relation. Review of Social Economy 54, 507–529. https://doi.org/10.1080/00346769600000031

Ingham, G., 2004. The Nature of Money, 1 edition. ed. Polity, Cambridge, UK ; Malden, MA.

Ingham, G., 2004a. The Nature of Money, 1 edition. ed. Polity, Cambridge, UK ; Malden, MA.

Ingham, G., 2004b. The Emergence of Capitalist Credit Money, in: Wray, L.R., Innes, A.M. (Eds.), Credit and State Theories of Money: The Contributions of A. Mitchell Innes. Edward Elgar Pub, Cheltenham, UK ; Northampton, MA, USA.

Innes, A.M., 1913. What is money? The Banking Law Journal 30.

Innes, A.M., 1914. Credit theory of money. The Banking Law Journal 31.

Jackson, A., 2013. The Chicago Plan & Positive Money's proposals - What is the difference? Posit. Money. URL https://positivemoney.org/2013/01/the-chicago-plan-versus-positive-money/ (accessed 7.19.19).

Jackson, A., Dyson, B., 2012. Modernising Money: Why Our Monetary System is Broken and How it Can be Fixed. Positive Money, London.

Jackson, T., Victor, P.A., 2015. Does credit create a 'growth imperative'? A quasi-stationary economy with interest-bearing debt. Ecol. Econ. 120, 32–48. https://doi.org/10.1016/j.ecolecon.2015.09.009

Jevons, W.S., 1879. The Theory of Political Economy, 2nd ed. Macmillan, London.

Jochimsen, M., Knobloch, U., 1997. Making the hidden visible: the importance of caring activities and their principles for any economy. Ecological Economics 20, 107–112. https://doi.org/10.1016/S0921-8009(95)00099-2

Jordan, G.J., Fortin, M.-J., 2002. Scale and topology in the ecological economics sustainability paradigm. Ecological Economics 41, 361–366. https://doi.org/10.1016/S0921-8009(02)00035-6

Kallis, G., Norgaard, R.B., 2010. Coevolutionary ecological economics. Ecological Economics, Special Section: Coevolutionary Ecological Economics: Theory and Applications 69, 690–699. https://doi.org/10.1016/j.ecolecon.2009.09.017

Keen, S., 2011. Debunking Economics - Revised and Expanded Edition: The Naked Emperor Dethroned?, 2 Exp Rev edition. ed. Zed Books, London.

Kennedy, M., 2012. Occupy Money: Creating an Economy Where Everybody Wins. New Society Publishers, Gabriola Islands.

Kenny, A., 1973. Anatomy of the Soul: Historical Essays in the Philosophy of Mind, First Edition edition. ed. Blackwell Publishers, Oxford.

Keynes, J.M., 1930. Treatise on Money: v. 1: The Pure Theory of Money, New Ed edition. ed. Palgrave Macmillan, London.

Keynes, J.M., 1936. The General Theory of Employment, Interest, and Money. Palgrave Macmillan, London, UK.

Kheel, M., 1993. From Heroic to Holistic Ethics: The Ecofeminist Challenge, in: Gaard, G. (Ed.), Ecofeminism: Women, Animals, Nature: 1st (First) Edition. Temple University Press.

Kiff, J., JKiff@imf.org, Elliott, J.A., JElliott@imf.org, Kazarian, E.G., EKazarian@imf.org, Scarlata, J.G., JScarlata@imf.org, Spackman, C., CSpackman@imf.org, 2009. Credit Derivatives: Systemic Risks and Policy Options? IMF Work. Pap. 09, 1. https://doi.org/10.5089/9781451874006.001

Knapp, G.F., 1924. The State Theory of Money. Macmillan & Co., London.

Krugman, P., 2011. IS-LMentary. The Conscience of a Liberal. URL https://krugman.blogs.nytimes.com/2011/10/09/is-lmentary/

Krugman, P., 2012. Banking Mysticism. The Conscience of a Liberal. URL https://krugman.blogs.nytimes.com/2012/03/27/banking-mysticism/

Krugman, P., 2012b. Minsky and Methodology (Wonkish). The Conscience of a Liberal.

Lapavitsas, C., 2010. Systemic Failure of Private Banking: A Case for Public Banks, in: Arestis, P., Sawyer, M. (Eds.), 21st Century Keynesian Economics, International Papers in Political Economy Series. Palgrave Macmillan UK, London, pp. 162–201. https://doi.org/10.1057/9780230285415_5

Lapavitsas, C., 2013. Profiting without producing: how finance exploits us all / Costas Lapavitsas. Verso, London ; New York.

Lawn, P., 2010. Facilitating the transition to a steady-state economy: Some macroeconomic fundamentals. Ecological Economics 69, 931–936. https://doi.org/10.1016/j.ecolecon.2009.12.013

Lawson, T., 2013. What is this 'school' called neoclassical economics? Cambridge J Econ 37, 947–983. https://doi.org/10.1093/cje/bet027

Lea, S.E.G., Webley, P., 2006. Money as tool, money as drug: The biological psychology of a strong incentive. Behavioral and Brain Sciences 29, 161–209. https://doi.org/10.1017/S0140525X06009046

Li, H., 1993. A Cross-Cultural Critique of Ecofeminism, in: Gaard, G. (Ed.), Ecofeminism: Women, Animals, Nature: 1st (First) Edition. Temple University Press.

Lietaer, B., Arnsperger, C., Goerner, S., Brunnhuber, S., 2012. Money and Sustainability: The Missing Link. Triarchy Press Ltd.

Linklater, A., 2015. Owning the Earth: The Transforming History of Land Ownership, Reprint edition. ed. Bloomsbury USA.

Locke, J., 1947. Two Treatises of Government: With a Supplement, Patriarcha, by Robert Filmer. Simon and Schuster.

Lutz, F.A., 1969. Roads to Freedom: Essasy in Honour of Friedrich A. von Hayek. Augustus M. Kelley Publishers, New York, NY.

Madrick, J., 2014. Seven Bad Ideas: How Mainstream Economists Have Damaged America and the World. Knopf Doubleday Publishing Group.

Mankiw, N.G., 2008. Macroeconomics, 6th Edition. ed. Worth Publishers, New York, NY.

Mankiw, N.G., 2013. Macroeconomics / N. Gregory Mankiw., 8th ed.. ed. Worth, New York, NY.

Mann, M., 1986. The sources of social power / Michael Mann. Cambridge University Press, Cambridge [England].

Martin, F., 2015. Money: The Unauthorized Biography--From Coinage to Cryptocurrencies. Vintage, New York.

Marx, K., 1970. Contribution to the Critique of Political Economy. Progress Publishers, Moscow.

Maucourant, J., 1993. Au coeur de l'économie politique, la dette. L'approche de J.R. Commons. Revue du MAUSS 2.

Mazzucato, M., 2018. The Value of Everything: Making and Taking in the Global Economy. PublicAffairs, New York.

McLeay, M., Radia, A., Thomas, R., 2014. Money creation in the modern economy.

Mcmahon, M., 1997. From the ground up: ecofeminism and ecological economics. Ecol. Econ. 20, 163–173.

Meikle, S., 1994. Aristotle on Money. Phronesis 39, 26–44.

Mellor, M., 1997. Gender and the Environment, in: Redclift, M., Woodgate, G. (Eds.), The International Handbook of Environmental Sociology. Edward Elgar, Cheltenham, UK ; Northampton, MA, USA.

Mellor, M., 1997. Women, nature and the social construction of 'economic man.' Ecological Economics 20, 129–140.

Mellor, M., 2005. The politics of money and credit as a route to ecological sustainability and economic democracy. Capitalism Nature Socialism 16, 45–60. https://doi.org/10.1080/10455750500108286

Mellor, M., 2005. Ecofeminist Political Economy: Integrating Feminist Economics and Ecological Economics, in: Perkins, E., Kuiper, E. (Eds.), Explorations: Feminist Ecological Economics. Feminist Economics, pp. 107–150.

Mellor, M., 2009. Ecofeminist Political Economy and the Politics of Money, in: Salleh, A. (Ed.), Eco-Sufficiency and Global Justice: Women Write Political Ecology. Pluto Press, London ; New York, NY : North Melbourne, Vic. : New York, NY.

Mellor, M., 2010. The Future of Money: From Financial Crisis to Public Resource. Pluto Press, London ; New York : New York.

Mellor, M., 2010b. Could the money system be the basis of a sufficiency economy? real-world economics review 79–88.

Mellor, M., 2012. Money as a Public Resource for Development. Development 55, 45–53. https://doi.org/10.1057/dev.2011.107

Mellor, M., 2015. Debt or Democracy: Public Money for Sustainability and Social Justice. Pluto Press.

Merchant, C., 1990. The Death of Nature: Women, Ecology, and the Scientific Revolution, Reprint edition. ed. HarperOne, New York.

Michel, A., Hudon, M., 2015. Community currencies and sustainable development: A systematic review. Ecol. Econ. 116, 160.

Mill, J.S., 1974. Principles of Political Economy. Penguin Books, Harmondsworth.

Miller, E., 2004. A Treatise on the Ecological Economics of Money.

Minsky, H., 1977. The Financial Instability Hypothesis: An Interpretation of Keynes and an Alternative to Standard Theory. Challenge 20, 20–27. https://doi.org/10.1080/05775132.1977.11470296

Minsky, H., 1986. Stabilizing an Unstable Economy, 1 edition. ed. McGraw-Hill Education, New York, NY.

Munda, G., 1997. Environmental Economics, Ecological Economics, and the Concept of Sustainable Development. Environmental Values 6, 213–233. https://doi.org/10.3197/096327107X243277

Muzio, T.D., Robbins, R.H., 2017. An Anthropology of Money: A Critical Introduction, 1 edition. ed. Routledge, New York.

Nadeau, R.L., 2015. The unfinished journey of ecological economics. Ecological Economics 109, 101–108.

Nelson, A., 2001. The poverty of money:: Marxian insights for ecological economists. Ecological Economics 36, 499–511. https://doi.org/10.1016/S0921-8009(00)00248-2

Nelson, J.A., 1997. Feminism, ecology and the philosophy of economics. Ecological Economics 20, 155–162.

Nielsen‐Pincus, M., Moseley, C., 2013. The Economic and Employment Impacts of Forest and Watershed Restoration. Restor. Ecol. 21, 207‐214. https://doi.org/10.1111/j.1526-100X.2012.00885.x

Norgaard, R.B., 1989. The case for methodological pluralism. Ecological Economics 1, 37–57. https://doi.org/10.1016/0921-8009(89)90023-2

Norgaard, R.B., 2010. Ecosystem services: From eye-opening metaphor to complexity blinder. Ecological Economics, Special Section - Payments for Environmental

Services: Reconciling Theory and Practice 69, 1219–1227. https://doi.org/10.1016/j.ecolecon.2009.11.009

Odum, H.T., 1973. Energy, ecology, and economics. Ambio 2.

Ogura, Y., 2018. The objective function of government-controlled banks in a financial crisis. J. Bank. Finance 89, 78–93. https://doi.org/10.1016/j.jbankfin.2018.01.015

Perkins, E., 2005. Explorations: Feminist Ecological Economics. Feminist Economics.

Piketty, T., 2014. Capital in the Twenty First Century. Belknap Press: An Imprint of Harvard University Press, Cambridge Massachusetts.

Plato, 2008a. Timaeus and Critias, Revised edition. ed. Penguin Classics, London.

Plato, 2008b. Phaedo. Arc Manor.

Plumwood, V., 1993. Feminism and the mastery of nature / Val Plumwood., Opening out. Routledge, London ; New York.

Polanyi, K., 2001. The Great Transformation: The Political and Economic Origins of Our Time, 2 edition. ed. Beacon Press, Boston, MA.

Rees, W.E., 1998. How should a parasite value its host? Ecological Economics 25, 49–52. https://doi.org/10.1016/S0921-8009(98)00015-9

Rezai, A., Stagl, S., 2016. Ecological macroeconomics: Introduction and review. Ecological Economics 121, 181–185. https://doi.org/10.1016/j.ecolecon.2015.12.003

Rezende, F., 2015. Why Does Brazil's Banking Sector Need Public Banks? What Should BNDES Do? (SSRN Scholarly Paper No. ID 3102138). Social Science Research Network, Rochester, NY.

Ricketts, T., 2018. Opening Plenary.

Ritter, J.A., 1995. The Transition from Barter to Fiat Money. The American Economic Review 85, 134–149.

Roberds, W., Velde, F.R., 2014. Early Public Banks (SSRN Scholarly Paper No. ID 2399046). Social Science Research Network, Rochester, NY.

Robertson, J., 2012. Future money: breakdown or breakthrough? Green Books, Totnes.

Roma, A., 2006. Energy, money, and pollution. Ecological Economics 56, 534–545.

Roma, A., Pirino, D., 2009. The extraction of natural resources: The role of thermodynamic efficiency. Ecological Economics 68, 2594–2606. https://doi.org/10.1016/j.ecolecon.2009.04.013

Røpke, I., 1999. FORUM: Prices are not worth much. Ecological Economics 29, 45–46. https://doi.org/10.1016/S0921-8009(98)00078-0

Røpke, I., 2004. The early history of modern ecological economics. Ecological Economics 50, 293–314. https://doi.org/10.1016/j.ecolecon.2004.02.012

Røpke, I., 2015. Reflections on full reserve banking and sustainability in a long term perspective. Presented at the Annual Conference of the European Association for Evolutionary Political Economy, Work In Progress.

Ruml, B., 1946. Taxes For Revenue Are Obsolete. Am. Aff. VIII, 35–39.

Ruml, B., 1946. Taxes For Revenue Are Obsolete. American Affairs VIII, 35–39.

Russ, M., 2016. The probable foundations of sustainabilism: Information, energy and entropy based definition of capital, Homo Sustainabiliticus and the need for a "new gold." Ecological Economics 130, 328–338. https://doi.org/10.1016/j.ecolecon.2016.07.013

Ryan-Collins, J., Greenham, T., Werner, R., Jackson, A., 2012. Where Does Money Come From?: A Guide to the UK Monetary & Banking System, 2nd edition. ed. New Economics Foundation, London.

Ryan-Collins, J., Lloyd, T., Macfarlane, L., 2017. Rethinking the Economics of Land and Housing. Zed Books, London.

Samuelson, P., 1948. Economics: The Original 1948 Edition, 1 edition. ed. McGraw-Hill Education, New York.

Samuelson, P.A., 1958. An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money. Journal of Political Economy 66, 467–482. https://doi.org/10.1086/258100

Say, J.B., 1852. A treatise on political economy : or The production, distribution, and consumption of wealth.

Scheffer, M., Carpenter, S.R., Lenton, T.M., Bascompte, J., Brock, W., Dakos, V., van de Koppel, J., van de Leemput, I.A., Levin, S.A., van Nes, E.H., Pascual, M., Vandermeer, J., 2012. Anticipating Critical Transitions. Science 338, 344–348.

Schumpeter, J.A., 1954. History of Economic Analysis. Allen & Union, London.

Shen, C.-H., Lin, C.-Y., 2012. Why government banks underperform: A political interference view. J. Financ. Intermediation 21, 181–202. https://doi.org/10.1016/j.jfi.2011.06.003

Shiva, V., Mies, M., 1993. Ecofeminism. Zed Press, London.

Simmel, G., 2004. The Philosophy of Money, 3 edition. ed. Routledge, Abingdon, Oxon ; New York.

Simons, H.C., 1948. Economic Policy for a Free Society. University of Chicago Press, Chicago, IL.

Singh, N.M., 2015. Payments for ecosystem services and the gift paradigm: Sharing the burden and joy of environmental care. Ecological Economics 117, 53–61. https://doi.org/10.1016/j.ecolecon.2015.06.011

Smith, A., 1976. An inquiry into the nature and causes of the wealth of nations / Adam Smith ; general editors R. H. Campbell and A. S. Skinner ; textual editor W. B. Todd., Glasgow edition of the works and correspondence of Adam Smith ; 2. Clarendon Press, Oxford.

Smith, S., 2017. The Economist's Tale : How Technology Enables a National Income, the End of Income Taxes, and a Balanced Budget [WWW Document]. URL https://www.ebay.com/itm/The-Economists-Tale-How-Technology-Enables-a-National-Income-the-End-of-/143019576629 (accessed 9.3.19).

Soddy, F., 1930. Wealth, Virtual Wealth and Debt The Solution of the Economic Paradox. Omni.

Soddy, F., 1935. The role of money; what it should be, contrasted with what it has become. Harcourt, Brace and Co, New York.

Soddy, F., 2012. Cartesian Economics: The Bearing of Physical Science Upon State Stewardship. Cosimo Classics, New York, N.Y.

Spash, C., 1999. The Development of Environmental Thinking in Economics. Environmental Values 8, 413–435.

Spash, C., 2012. New foundations for ecological economics. Ecological Economics 77, 36.

Spash, C.L., 2013. The shallow or the deep ecological economics movement? Ecological Economics 93, 351–362. https://doi.org/10.1016/j.ecolecon.2013.05.016

Spencer, P., Perkins, P.E., Erickson, J.D., 2018. Re-establishing Justice as a Pillar of Ecological Economics Through Feminist Perspectives. Ecol. Econ. 152, 191–198. https://doi.org/10.1016/j.ecolecon.2018.05.022

Svartzman, R., Ament, J., 2019. Money, interest rates, and accumulation on a finite planet: revisiting the 'monetary growth imperative' through institutionalist approaches, in: A Research Agenda for Ecological Economics. Edward Elgar.

Svartzman, R., Dron, D., Espagne, E., 2019. From ecological macroeconomics to a theory of endogenous money for a finite planet. Ecol. Econ. 162, 108–120. https://doi.org/10.1016/j.ecolecon.2019.04.018

Théret, B., 1999. The Socio-Political Dimensions of the Currency: Implications for the Transition to the Euro. Journal of Consumer Policy 22, 51–79. https://doi.org/10.1023/A:1006142028937

Timberlake, R., 1978. The origins of central banking in the United States / Richard H. Timberlake, Jr. Harvard University Press, Cambridge, Mass.

Tolle, M., 2016. Central bank digital currency: the end of monetary policy as we know it? Bank Undergr. URL https://bankunderground.co.uk/2016/07/25/central-bank-digital-currency-the-end-of-monetary-policy-as-we-know-it/ (accessed 9.3.19).

Varian, H., 2014. Intermediate Microeconomics: A Modern Approach, 9 edition. ed. W. W. Norton & Company, New York London.

Velde, F., 2018. The Neapolitan Banks in the Context of Early Modern Public Banks. https://doi.org/10.13140/RG.2.2.11171.76327

Villar, L., Briozzo, A., Pesce, G., Fernandez, A., 2016. El rol de la banca publica en el financiamiento a pymes. Estudio comparativo para la Argentina y Brasil. (The Role of Public Banks in Financing SMEs: Comparative Study for Argentina and Brazil. With English summary.). Desarro. Soc. 205–241.

Walras, L., 1954. Elements of Pure Economics, or The Theory of Social Wealth. Jarrold and Sons Ltd, Great Britain.

Warren, K., 1990. The power and the promise of ecological feminism. Environmental Ethics 12, 125.

Werner, R., 2011. ECONOMICS AS IF BANKS MATTERED: A CONTRIBUTION BASED ON THE INDUCTIVE METHODOLOGY. Manch. Sch. 79, 25–35. https://doi.org/10.1111/j.1467-9957.2011.02265_5.x

Wheelan, C., Malkiel, B.G., 2010. Naked Economics: Undressing the Dismal Science, Fully Revised and Updated edition. ed. W. W. Norton & Company, New York.

Wironen, M.B., Bennett, E.M., Erickson, J.D., 2018. Phosphorus flows and legacy accumulation in an animal-dominated agricultural region from 1925 to 2012. Glob. Environ. Change 50, 88–99. https://doi.org/10.1016/j.gloenvcha.2018.02.017

Wray, L.R., 2004. Conclusion: The Credit Money and State Money Approaches, in: Wray, L.R., Innes, A.M. (Eds.), Credit and State Theories of Money: The Contributions of A. Mitchell Innes. Edward Elgar Pub, Cheltenham, UK ; Northampton, MA, USA.

Wray, L.R., 2015. Modern Money Theory: A Primer on Macroeconomics for Sovereign Monetary Systems, 2 edition. ed. Palgrave Macmillan, Houndmills, Basingstoke, Hampshire ; New York, NY.

Wray, L.R., Innes, A.M., 2004. Credit and State Theories of Money: The Contributions of A. Mitchell Innes. Edward Elgar Pub, Cheltenham, UK ; Northampton, MA, USA.

Yeyati, E.L., Micco, A., Panizza, U., 2007. A Reappraisal of State-Owned Banks. Econ. J. Lat. Am. Caribb. Econ. Assoc. 7, 209–47, 256–59.

Zencey, E., 2009. Fixing Locke: Civil Liberties on a Finite Planet.