Essays on liquidity-based asset classification and illegal means of payment : an economic and philosophical approach

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Essays on liquidity-based asset classification and illegal means of payment

An economic and philosophical approach

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1.1 Liquidity: a slippery concept

Liquidity shares the same ephemeral property as your first love, sunny days, and the irreplaceable taco place down the street that has just closed: you don't know what you've got until it's gone. Economists have come to full awareness of this lesson, although only through the pain of seeing liquidity disappear before their eyes. While Lucas (2014, p. 199) mentions that 'financial panics are the results of sudden declines in liquidity,' Morris and Shin (2008, p. 242) make it clear that 'when liquidity dries up, it disappears altogether rather than being reallocated elsewhere.' Unsurprisingly, recent episodes of liquidity shortage have lead economists to work towards an economic theorizing better suited to the study of liquidity (Brunnermeier, 2010). However, what may be surprising is that despite all this sophisticated theorizing there is still no consensus definition of liquidity. Rather, what we find is the frank admission that it 'is easier to recognize than to define' (Crockett, 2008, p. 14).

Liquidity refers to a complex phenomenon with multiple dimensions, some of which refer to attributes of assets while others to states of markets or individuals (Amihud et al., 2006; Crockett, 2008; Lagos, 2008). There is at present no theory of liquidity with the ambition to address all these dimensions within a single framework. Instead, economics and finance offer various theories each designed to deal only with either one or a few dimensions of liquidity. This strategy has surely had a positive impact on the development of distinct theoretical approaches and the flourishing of innovative work.[1] However, a downside is that the heterogeneity of theoretical approaches has made the terminology more confusing. As Tirole (2008, p. 54) says, 'An unfortunate habit of economists is the use of the same word, "liquidity", to cover distinct concepts.' Different theories thus understand liquidity in their own way with the consequence that liquidity is identified with different things according to the branch of the literature one focuses on.

The difficulty to pin down a single concept of liquidity is far from new. From the moment when Keynes made the word popular in economics, liquidity has been a concept with a 'dangerous tendency to be slippery in meaning' (Hicks, 1962, p. 789). For Hicks (1962), some of the slipperiness is due to the two ways in which Keynes launched the concept of liquidity. On the one hand, liquidity made its way onto the world of theoretical economics through *The General Theory* and the argument for the Liquidity Preference. On the other hand, liquidity also arrived to the world of bankers

[1] See, for example, the literature surveys by Amihud et al. (2006), Tirole (2011), and Lagos et al. (2017).

and policy makers through Keynes' contribution to the Macmillan Report and *The Treatise on Money* (Beggs, 2015). The notion of liquidity depicted in *The Treatise* is not the same as the Liquidity Preference and is rather closer to what will be called below *market liquidity*. Indeed, the recent revival of interest in the debate about the notion of liquidity in Keynes reflects that the space of possible interpretations about liquidity can be enormous even for one single author (Hayes, 2018; Culham, 2019).

Currently, the uses of liquidity in economics and finance tend to fall in one of the following four senses.[2] First, liquidity may refer to *central bank liquidity* which is a term that describes the reserves held by financial institutions at the central bank (Cecchetti et al., 2010). Such reserves allow financial institutions to either meet reserve requirements or attain final settlement of transactions in the payments system. While there is an interbank market where financial institutions can borrow and lend reserves, the only institution with the power to inject new reserves is the central bank itself. Second, liquidity may be understood as *funding liquidity* which is a term that describes the ability of an individual or institution to raise cash in short notice by either borrowing or selling assets (Brunnermeier and Pedersen, 2009). Third, liquidity may also refer to *market liquidity*. This type of liquidity is widely studied in finance and describes the ease and speed with which an asset can be converted into cash (Mishkin and Eakins, 2006). Thus, *market liquidity* includes elements of time, volume, and transaction costs (Nikolaou, 2009).

A fourth sense in which liquidity can be understood is that of *exchange liquidity*, primarily studied by monetary economists (Lagos, 2008). This type of liquidity 'has to do with the ease at which [an asset] can be used to finance a random spending opportunity' (Rocheteau and Nosal, 2017, p. xxv). Monetary economists have resorted to the notion of *exchange liquidity* to explain the value of *fiat money*, i.e., an object that has no intrinsic value and is not convertible. Indeed, a dollar bill is an enigmatic asset: What can you do with a dollar bill? If one is adept at origami, maybe you could make a paper crane; but most of us are sadly not that dexterous. It is also unfortunate that a dollar bill, being paper, is not that desirable for direct consumption. Nonetheless, in many trades people readily accept a dollar bill as payment for a good or service. The puzzle then is that a dollar bill is an asset with a positive value in trade, but whose fundamental value is nil.

Monetary economics has offered an answer to this puzzle. The basic idea being that without a means of payment people could not carry out many mutually beneficial exchanges. A dollar bill is thus positively valued because it facilitates exchange. However, assets can facilitate exchange in more than one way. One is certainly by being used as a means of payment; another, by serving as collateral. Consider, for example, a household that obtains from the seller a consumption credit line collateralized by a mortgage. Beyond the contractual complexities, the physical house is an asset that works as collateral and allows the household to acquire directly goods and services from the seller. Either as a means of payment or as a collateral, assets are providing what monetary economists technically call *liquidity services*.

[2]For a more detailed presentation of the first three senses, see Nikolaou (2009).

Market liquidity differs from *exchange liquidity* in that the latter focuses on the direct ability of an asset to facilitate exchange. While a dollar bill can be used directly in trade to purchase goods and services from sellers, other financial assets first have to be sold on the (secondary) market, and only then the cash raised can be used to make payments. In this regard, such financial assets are considered to have an indirect ability to facilitate exchange. There is a recent effort aimed at achieving a unification of *market liquidity* and *exchange liquidity* (Geromichalos et al., 2019), but it is still too early to know if this effort will succeed.

I am mainly interested in the *direct* ability of assets to facilitate trade; thus in the rest of the thesis, unless otherwise indicated, I understand liquidity as *exchange liquidity*. For monetary economists, such a notion of liquidity refers to the *degree* which assets are useful either as means of payment or collateral in facilitating transactions (Lagos et al., 2017).

1.2 Liquidity-based asset classification and natural kinds

Liquidity is a property that allows economists to devise a classification of assets. Perhaps the most popular asset classification is the one that distinguishes between the categories 'money' and 'non-money.' We could, for instance, claim that an asset belongs to the category 'money' if such an asset works as a means of payment. Therefore, if the asset in question is a dollar bill, we can conclude that it belongs to 'money.' However, liquidity was defined above in terms of *assets that facilitate transactions* rather than simply in terms of *assets that are a means of payment*. In that sense, there are other ways to classify assets based on liquidity. We could then say that any asset that provides liquidity services either as a means of payments and/or as collateral will belong to a category that we decide to name 'liquid assets.' Thus, for instance, both a dollar bill that is widely used as a means of payment and a Treasury bond that is widely accepted as collateral will belong to 'liquid assets.'

Classifying assets based on their liquidity raises some questions. However, to accurately present such questions, we have first to introduce a distinction made by philosophers between two sorts of classifications. On the one hand, there are classifications that are a purely arbitrary matter. As an example, let us imagine that we arbitrarily create the category 'objects that are currently in my visual field' (Koslicki, 2008). This first sort of classification corresponds to what philosophers term *spurious*, *phony*, or *arbitrary kinds*. On the other hand, there are classifications that, rather than imposing a division on the world, capture a division found in the world. A standard example is the category 'copper' (Brzović, 2019). This sort of classification corresponds to the so-called *natural kinds*.[3]

While there are different accounts of natural kinds, we can identify at least two

[3]The term 'natural kind' wrongly suggests that only groupings identified the by physics, chemistry, or biology can be natural kind candidates. As Khalidi (2013, p. 5) remarks, 'It might have been better to use Mill's expression "real kind" instead, but unfortunately that expression has never caught on and is not a widely used expression.'

generic features (Brzović, 2019). First, a natural kind refers to a set of properties that are shared by all the members of the kind. Second, the properties shared by a natural kind's members are not accidental; there must be an explanation for this grouping of properties. Considering 'copper' to be natural kind, Brzović (2019, italics added) points out that,

> All instances of copper share some *common properties*: They are soft, malleable, and ductile, with a reddish-orange color. These observable features can be *accounted for* by the atomic structure of copper, namely that it has a nucleus containing 29 protons and 34 to 36 neutrons and it is surrounded by 29 electrons localized in 4 shells. Like other metals, it consists of a lattice of atoms and has a single electron in the outer shell that does not remain connected to particular atoms but forms an electron cloud spreading through the lattice. This cloud, containing many dissociable electrons, makes the conduction of electric currents possible.

The contrast again with spurious kinds helps understand the reason why natural kinds are precious for the scientific activity. Let us return to the example of the category 'objects that are currently in my visual field.' If we attempt to use it to make inductive inferences over as-of-yet unobserved members, we will surely come to the realization that such a category does not perform well. As Koslicki (2008, p. 791) has noted, the problem with this spurious kind is that 'their members lack any other common characteristics [...] besides the feature by means of which they are categorized under a common heading.' In contrast, categories that do correspond to natural kinds play a role in supporting the inductive inference. In particular, knowledge of a natural kind's current members can ground inductive inferences about new or hypothetical objects that arguably have the same kind of membership (Hacking, 1991; Brigandt, 2011). Thus, for instance, Koslicki (2008, p. 790) mentions that 'from the premise that all observed samples of copper in the past have been found to conduct electricity we can legitimately infer that the next observed sample of copper will conduct electricity.'

Furthermore, natural kinds can support scientific explanation. If one, for example, endorses the view that scientific explanation should rely on scientific laws, then one may claim that natural kinds justify making law-like generalizations. As all instances of copper have the same atomic structure and such a structure explains electric conductivity, Brzović (2019) argues that we cannot 'only [...] infer that a subsequently observed instance of copper will conduct electricity, but also [...] establish it as a scientific law of the following form: "All pure copper conducts electricity".'

To summarize, natural kinds allow us to make reliable inductive inferences. The properties shared by all members of natural kind are not a mere product of coincidence. There must be an explanation for the properties associated to a natural kind. We can then make the correct inductive inference that an unobserved member will possess the same properties as members that have already been observed.

The thesis aims to address two main questions regarding certain features of liquidity-based asset classification. A first question is about the *validity* of such a classification: *Does liquidity-based asset classification pick out a natural kind?* The

implications of this query are non-trivial. Some philosophers have argued that the social sciences are too limited to yield knowledge about their subject matter as there are no natural kinds in their domain (Ellis, 2002/2014). In the absence of natural kinds, the argument goes, the social sciences do not have access to this inductive and explanatory support and thus are prone to deliver poorer scientific outcomes.

Indeed, this line of reasoning has been embraced by philosophers who see in the allegedly lack of natural kinds the main reason why economics, despite its advanced mathematical formalism, has failed to reach the scientific success of the natural sciences. Rosenberg (1992), for instance, has claimed that economics has made little progress in improving its predictive ability because its basic categories like 'beliefs' or 'desires' are intentional variables that belong to the domain of folk psychology. Thus, in his view, such categories lack the inductive-grounding ability of natural kinds:

> "Beliefs" and "desires" [...] do not describe "natural kinds." They do not divide nature at the joints. They do not label types of discrete states that share the same manageably small set of causes and effects and so cannot be brought together in causal generalizations that improve on our ordinary level of prediction and control of human actions (Rosenberg, 1992, p. 235).

Nelson (1990) has also endorsed a similar position but, in contrast to Rosenberg (1992), locates the problem in the category of 'commodity,'

> economics *never* gets it really right because *commodity* is not a natural kind. If commodities are not natural kinds in *any* society, there cannot be an empirical science about them. If I am right, we should not think of economics as a false theory about things that are in the world; its lack of success is, instead, inevitable because the things that it is supposed to be dealing with are not there (Nelson, 1990, p. 130, italics in the original).

In an early criticism of Rosenberg (1992) and Nelson (1990), Kincaid (1995) holds that these diagnoses suffer from the same problem: they treat economics as a homogeneous whole, thereby ignoring the diversity of economic research. Instead, he advocates for a discussion of natural kinds that 'pay[s] much more attention to empirical, local details of economic explanation' (Kincaid, 1995, p. 368). In line with this piece of advice, the thesis does not engage in the project of discussing the existence of natural kinds in economics as a whole. Rather, the thesis focuses on a more particular objective, namely, to determine whether liquidity-based asset classification designates a natural kind or not.

The second question is about the *extension* of the categories resulting from liquidity-based asset classification: *Is there a sharp boundary between categories of assets that are classified based on their liquidity?* This question is related to the philosophical debates about the boundaries of natural kinds. As we will see in section 1.3, standard theories of natural kinds disagree on whether such boundaries are sharp or fuzzy. The thesis engages in this philosophical debate, although with the aim of drawing conclusions that exceed the domain of philosophy. Economists have long discussed the criteria

that allow one to classify assets into distinct categories (Friedman, 1956; Friedman and Schwartz, 1970). For both the development of theoretical work and the elaboration of policy prescriptions, economists have recurrently faced the question 'is this money?' However, the recent resurgence of such a question is largely due to the emergence of cryptocurrencies like bitcoin.

Economists thus have offered arguments to determine whether cryptocurrencies should be regarded as money or not.[4] Yermack (2015), for instance, has pointed out that bitcoin seems a speculative investment rather than a currency as it does not fully perform the standard functions of money. In his own words:

> bitcoin fails to conform to the classical properties of a currency. A successful currency typically functions as a medium of exchange, a unit of account, and a store of value. Bitcoin faces challenges in meeting all three of these criteria (Yermack, 2015, p. 36).

In contrast, Hazlett and Luther (2019) maintain that the only criterion required to classify an item as money is that it functions as a commonly-accepted medium of exchange. They then compare the demand for bitcoin and the demand for many government-issued monies to show that bitcoin is not currently a global rival to the dollar. However, they find that in some internet transactions bitcoin is routinely used as a medium of exchange. Thus, they conclude that,

> Contra Yermack, the standard approach to considering whether an item is money merely requires one assess the extent to which it functions as a medium of exchange over the relevant domain. Nonetheless, we argue that bitcoin's routine use as a medium of exchange among some digital transactors makes it worthy of the label money, if only over a relatively small domain (Hazlett and Luther, 2019, p. 5-6).

Unlike these approaches, the thesis seeks to shed some light on this debate by adopting the perspective of natural kinds. Smit et al. (2016) have argued that a potential strategy to determine if bitcoin is or is not money consists in deciding if bitcoin possesses the common properties that define membership in the natural kind 'money.' However, one may then ask whether the boundaries of categories such as 'money' and 'non-money' are sharply defined. After all, that type of boundary is not entirely uncommon in science as it is the case of the classification of chemical elements in which the transition among the distinct categories is not gradual (Ellis, 2002/2014). The thesis thus discusses whether what is achieved for the case of chemical elements can also be applied to assets used in payments like bitcoin. That is, the aim is to determine if the liquidity-based asset classification results in a discrete break between categories or if rather the distinction is just a matter of degree.

To properly address the above questions a sound understanding of the work of monetary economists is needed, especially of that related to liquidity-based asset

[4] Apart from Yermack (2015) and Hazlett and Luther (2019), see also White (2015), Selgin (2015), Smit et al. (2016), and Baur et al. (2018).

classification. Nonetheless, a second level of reflection on the asset classification that monetary economists have devised in the study of their own subject matter is also needed. That is, rather than taking asset classification to be instrumental for the understanding of economic phenomena, liquidity-based asset classification in and of itself should become the subject matter of research. Here is where philosophy turns out to be helpful, as the study of the nature of scientific classifications is an area largely explored by philosophers of science. Therefore, the thesis connects philosophical insights about scientific classification with classificatory practices of monetary economists with the aim of delivering an answer to the above questions.

1.3 Two theories of natural kinds

Beyond the past two generic features, theories of natural kinds differ about the details of what it takes for a classification to count as a natural kind classification. There are two standard theories about natural kinds: *essentialism* and *homeostatic property cluster* theory.[5]

1.3.1 Essentialism

Essentialism is still the dominant theory of natural kinds. For a long time, essentialism was regarded as an old-fashioned Aristotelian philosophy. However, this view changed with the works of Kripke and Putnam who revived essentialism and made it respectable again (Ellis, 2002/2014). I mentioned above that a natural kind's members share non-accidentally a set of properties. Essentialism goes further and claims that what a natural kind's members actually share is a natural kind *essence*. Thus, for essentialists, spurious kinds differ from natural kinds in that the former lack essences.

Essentialists agree with non-essentialists that natural kinds ground inductive inferences. However, essentialists claim that it is the existence of an essence that 'causes and explains all other observable shared properties of the members of a kind and allows us to draw inductive inferences and formulate scientific laws' (Brzović, 2019). There is no consensus among essentialists about the exact features of an essence, but some features that appear in the essentialist literature are the following (Khalidi, 2013):

a-) *Necessity and sufficiency*: an essence consists of a set of properties whose possession is individually necessary and jointly sufficient for membership in a natural kind.

b-) *Modal necessity*: an essence consists of a set of properties that b.1-) are necessarily associated with the natural kind in every possible world such that b.2-) an individual member of the kind possess them in every possible world.

[5] Although it is not discussed in the thesis, another theory of natural kinds that has received attention from philosophers is the one developed by Dupré (1993) and in which he argues for what he calls *promiscuous realism*. For a more detailed presentation of the various theories of natural kinds, see Bird and Tobin (2018).

c-) *Intrinsicality*: an essence consists of a set of properties that are intrinsic to a natural kind's members.

Khalidi (2016) shows that some essentialists have also argued that:

d-) Essential properties generate sharp boundaries among natural kinds.

e-) Essential properties deliver a hierarchy of natural kinds such that they cannot crosscut one another.

Essentialists think that the above list contains the criteria to be used when deciding whether a category proposed by science is a natural kind or not. However, as essentialists are not agreed on the exact features of essences, it has led to the development of multiple versions of essentialism each subscribing to a different combination of requirements.

A well-known version of essentialism is the so-called *traditional essentialism* (Wilson et al., 2007). Traditional essentialists claim that a natural kind essence is the set of intrinsic properties that are necessary and sufficient for membership in a particular kind. As the natural kind essence only includes intrinsic properties of members of the kind, traditional essentialists claim that the boundaries among distinct categories are not the result of a human imposition but rather a reflection of divisions existing in nature. Similarly, as such intrinsic properties are individually necessary and jointly sufficient for kind membership, for traditional essentialism there is a discrete break between distinct natural kinds (Ellis, 2002/2014). The case of chemical elements previously mentioned is precisely a paradigmatic example of a classification that meets the requirements of traditional essentialism. For instance, while chlorine and argon are neighbors in the periodic table, 'there are no atoms that are intermediate between chlorine atoms and argon atoms, for the nucleus of an atom cannot have a number of protons between seventeen (chlorine) and eighteen (argon)' (Bird and Tobin, 2018). Therefore, in the version of traditional essentialism, a natural kind essence allows one to sharply demarcate the boundaries of natural kinds.

Essentialism still enjoys strong endorsement in some philosophical circles (Ellis, 2002/2014). However, it has also been the target of serious criticism from philosophers who feel that there is a 'misalignment between the claims of essentialism and the results of science' (Khalidi, 2016, p. 407). Such a misalignment is evident when it comes to the special sciences[6] where, for instance, kinds are usually characterized in terms of relational, functional, or historical properties rather than intrinsic properties. Perhaps more surprisingly, some philosophers have argued that at least certain essentialist requirements are even violated by some paradigmatic kinds of physics and chemistry (Needham, 2011; Tahko, 2015; Khalidi, 2016).

[6]The special sciences are defined as all those sciences above physics, including biochemistry, genetics and the distinct biological sciences, the brain sciences, cognitive science, psychology, and economics. See Fodor (1974, 1997) for a discussion.

1.3.2 Homeostatic property clusters (HPC)

A popular alternative to essentialism is the homeostatic property cluster (HPC) theory developed by Richard Boyd (1999). HPC theory departs from essentialism and pays more attention to details of the categories proposed by the special sciences. Indeed, HPC theory can be regarded as an effort to lay out some shortcomings of essentialism while preserving the idea that there are natural kinds in the domain of the special sciences. HPC theory does not claim a natural kind's members are grouped together because they all possess the same set of properties—i.e., a kind essence. Instead, HPC theory argues that kinds in the special sciences correspond rather to a *property cluster*. The following list summarizes the main features of natural kinds in the view of HPC theory (Craver, 2009):

a-) *Property cluster*: there is a cluster of properties that regularly co-occur.

b-) *Homeostatic mechanism*: a mechanism is responsible for the co-occurrence of the cluster of properties.

c-) *Causal import*: the cluster of properties features in important causal generalizations.

d-) *Accommodation*: categories should accommodate the causal structure of the world.

In describing natural kinds as corresponding to a property cluster, HPC theory refuses the essentialist requirement that there is a set of individually necessary and jointly sufficient properties that define kind membership (Boyd, 1999). The properties in the cluster are loosely associated with each other, i.e., the presence of a property makes it more likely the occurrence of another property but such a co-occurrence might not happen in some individuals. HPC theory thus is more permissive than essentialism to the extent a kind's members can share many but not necessarily all the properties forming the cluster (Khalidi, 2016). Furthermore, HPC theory does not require properties to be intrinsic. Cases of natural kinds typically studied by HPC theory exhibit relational or extrinsic properties. Accordingly, for HPC theory the boundaries of natural kinds are rather fuzzy and thus there is no discrete break among distinct natural kinds.

HPC theory claims that properties are not associated with each other by happenstance. Instead, there is a causal mechanism that is responsible for both giving rise to the property cluster and keeping it in equilibrium (Boyd, 1999). The causal mechanism also renders another function in HPC theory. For essentialists, natural kinds are individuated by the possession of the set of properties forming the natural kind essence. In contrast, HPC theory cannot use the cluster of properties to individuate kinds because the extension of natural kinds is fuzzy. Thus, to decide whether a given individual belongs to a certain kind, HPC theory employs the causal mechanism that holds the property cluster in place (Craver, 2009; Khalidi, 2016). For instance, an individual that lacks one property can still belong to the same kind as other individuals

who possess all the property cluster, as long as the individual in question is subject to the same mechanism that has led to the co-occurrence of the property cluster in other individuals.

On the HPC account, natural kinds participate in relevant generalizations. Natural kinds figure in scientific theories, supporting inductive inference and explanation. Therefore, HPC theory excludes categories with little or null epistemic value (Craver, 2009). Besides, HPC theory proposes the 'accommodation thesis,' i.e., the claim that we devise our categories in a manner that allows us to accommodate the causal structure of the world. If some categories are successful in grounding reliable inductive generalizations, it is because the relation proposed among distinct categories is a reflection of the causal structure of the world. In Boyd's (1999, p. 148) words,

> We are able to identify true generalizations in science and in everyday life because we are able to accommodate our inductive practices to the causal factors that sustain them. In order to do this—to frame such projectable generalizations at all—we require a vocabulary [...] which is itself accommodated to relevant causal structures.

HPC extended the theory of natural kinds to domains other than those of physics and chemistry (Wilson et al., 2007). However, Khalidi (2016) has noted that while a number of philosophers are persuaded that many kinds in the special sciences correspond to the description offered by HPC theory, others argue that HPC theory excludes some reliable scientific taxonomies.

So far the distinction between spurious kinds and natural kinds has been made in terms of classifications that, on one hand, impose a division on nature and classifications that, on the other, merely reflect an existing division of nature. However, we have seen that natural kind boundaries are fuzzy and that scientists fine tune their categories to accommodate the causal structure of the world. Thus, some philosophers have observed that an implication of HPC theory is that human interests play a part in the identification of natural kinds (Craver, 2009). Scientists decide, based on their explanatory and predictive interests, the final boundaries among distinct causal mechanisms—i.e., the limits where a mechanism starts and ends. They also decide the boundaries of a given property cluster, as when setting the number of properties to be finally included in the cluster.

Reydon (2009, p. 726) therefore argues that HPC theory conceives of the problem of natural kinds 'as foremost a question in epistemology, i.e., as the question [of] what ways of grouping things help us to make inferences and to explain phenomena,' and thus that on HPC view 'kind membership is decided more by us than by nature.' The intromission of human interests is not enough to render natural kinds and spurious kinds undistinguishable. Unlike spurious kinds, natural kinds have inductive-grounding ability. However, HPC theory makes the position that natural kinds merely reflect nature's own divisions and not ours untenable.

Throughout the thesis I will discuss these two standard theories of natural kinds, although with a special emphasis on traditional essentialism. The reason being that, as

Mäki (2009, p. 2) has identified, when investigating the nature of money 'economists have been inclined to adopt unashamedly essentialist ways of talking.' I will confront traditional essentialism and particularly the idea that it is possible to have a discrete break among distinct categories resulting from liquid-based asset classification.[7] Even though I mainly focus on arguing against traditional essentialism, I also examine HPC theory as a manner to articulate one of the main claims offered by the thesis: liquid-based asset classification is better understood through an alternative theory of natural kinds, namely, *functionalism*. The features of functionalism that I endorse will be presented in Chapter 3. In particular, I am interested in discussing the possibility that a given functional kind can be *multiply realized*. Multiple realization loosely refers to the ability of performing the same function in genuinely different ways. Thus, I will deal with to what extent a kind whose members are united by the functional property of liquidity can exhibit multiple realization.[8]

1.4 Institutional kinds

In *The Construction of Social Reality*, Searle (1995) starts his analysis by introducing a distinction between *brute facts* and *institutional facts*.[9] Brute facts are those that do not depend on human beliefs for their existence. That Mount Everest has snow near the summit or that hydrogen atoms have one electron are examples of brute facts as they exist independently of our opinions about them. In contrast, institutional facts require human beliefs for their existence. That the piece of paper in my pocket counts as money depends on people having the right belief that such a piece of paper is money. In Searle's view (1995, p. 33-34), this dependence on human beliefs is a trademark of facts belonging to the social world:

> Something can be a mountain even if no one believes it is a mountain; something can be a molecule even if no one thinks anything at all about it. But for social facts, the attitude that we take toward the phenomenon is partly constitutive of the phenomenon. If, for example, we give a big cocktail party, and invite everyone in Paris, and if things get out of hand, and it turns out that the casualty rate is greater than the Battle of Austerlitz – all the same, it is not a war; it is just one amazing cocktail party. Part of being a cocktail party is being thought to be a cocktail party; part of being a war is being thought to be a war. This is a remarkable feature of social facts; it has no analogue among physical facts.

Institutional kinds correspond to a grouping of properties typically exhibited by social objects. Such properties, in the same manner as institutional facts, require

[7] My criticism of essentialism thus takes place within the tradition of natural kinds. A different type of criticism has been developed by both philosophers and academics outside of philosophy departments who have embraced constructionist positions. Berg-Sørensen et al. (2010) offer a review of the debate between essentialism and constructivism.

[8] Apart from the references that will be provided in the other chapters, Wright (1973), Elster (1983), Pettit (1996), and more recently Hindriks and Guala (2019) also address various topics about functionalism.

[9] For an earlier contribution to the analysis of brute facts, see Anscombe (1958).

a certain type of human beliefs to exist. An example of such institutional kinds that repeatedly appears in Searle's (1995) theory is money.[10] Following a distinction introduced by Searle (1995), Khalidi (2013) claims that institutional kinds are epistemically objective and ontologically subjective. For Searle (1995, p. 8) the epistemic dimension applies primarily to judgments. Thus, a judgment is *epistemically subjective* when its truth or falsity depends on people's beliefs (e.g. 'Rembrandt is a better artist than Rubens'); in contrast, a judgment is *epistemically objective* when its truth or falsity can be established by comparing the content of judgment with facts (e.g. 'Rembrandt lived in Amsterdam during the year 1632'). However, Searle (1995) argues, the ontological dimension applies primarily to entities and is related to the mode of existence of such entities. Thus, for instance, atoms are *ontologically objective* because they need no human beliefs to exist, while money is *ontologically subjective* because its existence depends on human beliefs.

In particular, Searle (1995) holds that the creation of institutions like money require the collective acceptability of a constitutive rule. For Searle, there are two types of rules: rules that merely regulate an already existing activity and rules that create an activity. Traffic rules are an example of *regulative rules*: they do not create the activity of driving but only regulate it. On the contrary, the rules of chess are *constitutive rules* as they do not merely regulate but create the very activity of playing chess.[11] Therefore, following Searle's theory (1995), we could claim that the acceptability of the constitutive rule 'X counts as Y in C' is the basic mechanism through which institutional kinds are created. In the 'X counts as Y in C' formula, X names a physical object whereas Y names a status assigned to X. Let X be a piece of paper with certain physical characteristics and Y be money. It is clear that being a piece of paper with certain physical features is not enough to be money. For the piece of paper to achieve the status of money, we have to collectively accept the rule that 'A dollar bill (X) counts as money (Y) in the USA (C).'

The dependence of institutional kinds on human beliefs have sparked the debate about whether such kinds can be serious candidates for natural kinds. HPC theory made it explicit that a natural kind allows us to make generalizations because it identifies parts of the causal structure of the world. However, insofar as institutional kinds are dependent on our beliefs, they may merely be a product of human convention rather than of a causal mechanism that ensures the co-occurrence of properties. Thus, the concern is that institutional kinds 'are unlikely to be projectable and unlikely to be of any use for scientific purposes' (Guala, 2016a, p. 55).

[10] Searle does not use the term 'institutional kind' to refer to money but instead the term 'institutional fact.' However, as Epstein (2015, p. 59, italics in the original) has noted, this terminology is confusing because '[m]oney is not a fact—it is a social object, or maybe a social kind. *I have a dollar in my pocket*: that is a fact, a social fact. *A dollar exists*: that is a different social fact. *The bill in my pocket constitutes a dollar*: yet a different social fact. But *dollar*: that is a thing or a kind of thing, not a fact.' Others authors who have regarded money as a kind rather than a fact are Thomasson (2003), Mäki (2009), Khalidi (2013), Guala (2016a; 2016b; 2016c) and Epstein (2016).

[11] The distinction between two types of rules goes back to Rawls (1955). A contemporary discussion about the regulative versus constitutive rules can be found in Hindriks (2009) and Guala and Hindriks (2015). For a discussion of rules and money in the context of Searle's theory, see Smit et al. (2011) and Guzmán and Frasser (2017).

In the thesis, I take a critical stance on the view that ontological subjectivity prevents institutional kinds from supporting inductive inference and explanation. In particular, I draw heavily on the literature discussing the relation between human beliefs and institutional kinds to show that what is called *the mind-dependence problem* is not a threat to liquidity-based asset classification's natural kind status.[12]

1.5 The choice of monetary theory

The thesis relies on New Monetarist Economics as the monetary theory whose results, models, and categories are mainly studied in the analysis of liquidity-based asset classification. Furthermore, the thesis uses directly models developed by New Monetarists to study the circulation of an illegal means of payment in trade. New Monetarist Economics is often introduced by its adherents as an alternative to the New Keynesian approach to macroeconomics (Williamson and Wright, 2010a). It is well-known, for instance, that nominal rigidities are a key ingredient of the New Keynesian theory and its policy prescriptions. New Monetarists disagree with the excessive emphasis placed on nominal rigidities and prefer rather to emphasize the role played by other frictions such as limited commitment, imperfect monitoring, private information, and difficulties in coordinating trade. New Monetarists also point out that despite their importance for the New Keynesian theory, nominal rigidities in that approach are taken as a given rather than being endogenously derived from a pricing mechanism. Likewise, New Monetarists are unsatisfied with popular New Keynesian models in which either there is no money, or there is money that just appears as an argument of the utility function or as a cash-in-advance constraint.

I do not go into details about the above points as the thesis starts by providing the reader with a review of the main historical influences and methodological traits of New Monetarist Economics. Such a review will show that the debates of monetary theory in which I am mainly interested are those closely related to issues such as *the integration of value and monetary theory* and *the positive price problem of money*. It is in this specific theoretical context in which I chose New Monetarist Economics as the starting point of the philosophical and economical work developed in the thesis. I am sympathetic to the New Monetarist view that we need a theory that offers an explicit description of exchange process. As Lagos et al. (2017, p. 372) point out, 'In Arrow-Debreu, agents are endowed with a vector $\bar{\boldsymbol{x}}$, and choose another $\boldsymbol{x}$ subject only to $\boldsymbol{px} \leq \boldsymbol{p\bar{x}}$, with $\boldsymbol{p}$ taken as given; how they get from $\bar{\boldsymbol{x}}$ to $\boldsymbol{x}$ is not discussed.' I also endorse the New Monetarist view that it is important to study monetary phenomena with models where money matters, in the sense that agents do better when they have money than when they do

[12]Mind-independence is an important issue in the debates about realism as, for many realist philosophers, mind-independence is a criterion to determine what exists in the world. Thus, for instance, Devitt (2006, p. 101) claims that: 'The general doctrine of realism about the external world is committed not only to the existence of this world but also to its "mind-independence": it [...] does not depend for its existence and nature on the cognitive activities and capacities of our minds.'

not. New Monetarists call this property, after Hahn (1973), the essentiality of money.[13] I cannot improve on Wallace (2001, p. 849) when he claims that 'I think most economists want to have models of money in which it is essential. Otherwise, why bother with money?'

I am aware that the history of monetary economics covers more theories than those appearing in the debates about *the integration of value and monetary theory.* Indeed, Schumpeter (1954, p. 27) proposed a distinction that is able to encompass a large number of very distinct monetary theories.[14] Monetary theories can be sorted out into:

- *Real Analysis*: it 'proceeds from the principle that all the essential phenomena of economic life are capable of being described in terms of goods and services, of decisions about them, and of relations between them. Money enters the picture only in the modest role of a technical device that has been adopted in order to facilitate transactions [...] so long as it functions normally, it does not affect the economic process, which behaves in the same way as it would in a barter economy.'

- *Monetary Analysis*: it 'spells denial of the proposition that [...] the element of money is of secondary importance in the explanation of the economic process of reality' and also 'introduces the element of money on the very ground floor of our analytic structure and abandons the idea that all essential features of economic life can be represented by a barter-economy model.'

This classification has been endorsed by scholars who have seen it as useful way to organize the discussion and articulate a position in favor of Monetary Analysis (Cartelier, 1985, 2018; Ingham, 1996, 2004). In this taxonomy of monetary theories, seminal contributions by New Monetarists are typically labeled as 'Real Analysis,' which is also a label often associated to 'orthodox' or 'mainstream' views of money. This is not a thesis about the history of monetary theories. I do not claim expertise on the entire spectrum on theories associated to Monetary Analysis, nor is my objective to settle long debates between the so-called 'orthodox' and 'heterodox' theories, and then to declare a winner. This is a thesis about classifications and, in particular, a thesis that opposes the idea that there is a discrete break among certain categories. I thus lean towards being skeptical about classifications that postulate a sharp demarcation.[15] I cannot help suggesting that we listen again to a key advocate of the Real-Monetary Analysis distinction:

> We are defining both Real and Monetary Analysis as *pure types* in order to convey an important truth. In actual practice, neither type is ever pure. Hence the contrast between them is less sharp than we are forced to make it. There are many midway houses. And neither Real nor Monetary Analysis can ever get along without using concepts and arguments that strictly speaking belong to the other (Schumpeter,

[13] Note that essential money in this case has nothing to do with essentialism of natural kinds.

[14] The roots of the distinction offered by Schumpeter can be traced back to *the classical dichotomy*. For a review of this dichotomy, see Fields (2015).

[15] 'This should not prevent us from taking seriously Schumpeter's proposition [...] and from sharply distinguishing between different theories according to the predominance of one or the two postulates: commodity space or payment system (money)' (Cartelier, 2018, p. 4).

1954, p. 277, italics added).

I agree: 'There are many midway houses.' By way of example, New Monetarists see money as an asset that 'facilitate[s] transactions' but they do not think money is an issue of 'secondary importance.' New Monetarists study 'barter economies' but they do not think monetary economies 'behave in the same way as' barter economies. Rather, New Monetarists compare different alternatives including autarky and credit economies to understand why monetary economies may be preferred to exploit the gains from trade. I also believe that New Monetarists offer us a fruitful way to think about money, credit, liquidity, and related issues; however, I do not believe they have all the answers to the complex challenges such issues pose. There are insightful ideas in alternative approaches and on occasion I will draw on some of them to strengthen the arguments presented in the thesis.[16]

1.6 Thesis' contribution

The thesis does not aim to offer a new *metaphysical* theory about what natural kinds are. Rather, the thesis is interested in natural kinds from the perspective of the *philosophy of science*. Thus, the thesis seeks to contribute to the study of the use and features of natural kinds in economics.

The general answer offered by the thesis concerning the *validity* and *extension* of liquidity-based asset classification can be summarized as follows. Liquidity can be used to create a taxonomy of assets in which such assets are grouped into categories according to the liquidity services they provide. I use the case of the category 'liquid assets' to show that liquidity is a *functional* property that can be realized in two genuinely different ways. Assets can render liquidity services through either monetary trades or credit trades. Regardless of whether they are traded via monetary or credit trades, assets belonging to the kind 'liquid assets' have a common property. They are also valued by their liquidity services, therefore their prices can depart from the fundamental value. The thesis thus argues that 'liquid assets' can be regarded as a *functional kind* with multiple realizations.

Furthermore, liquidity is a property influenced by social and institutional practices in which the human mind inevitably intervenes. However, such a mind-dependence does not necessarily prevent liquidity-based asset classification from having causal powers and inductive and explanatory potential. The case of 'liquid assets' illustrates that liquidity-based asset classification can play an epistemic role in explanatory models. Because of its ability to ground inductive inference and explanation, I conclude that the category 'liquid assets' designates a natural kind according to the functionalist approach.

[16]Sophisticated supporters of Monetary Analysis also allow themselves to learn from the other side. Consider again Cartelier (2018, p. 7), who before fully displaying his impressive erudition of monetary theory, warns his readers: 'Even if we think that a monetary analysis is more fruitful and more relevant than value theories, we do not maintain that the former brings better answers than the latter to the questions the existence of money commonly raises.'

A more restrictive category than 'liquid assets' is 'money.' 'Money' includes all assets that have achieved a certain threshold of liquidity by serving as a means of payment either via monetary or credit trades. Thus, unlike 'liquid assets,' the category 'money' excludes assets serving as collateral. I use the case of 'money' to discuss if it is possible to find an unambiguous distinction between categories resulting from liquid-based asset classification. There is a view in economics that claims that there is a discrete break between the categories of 'money' and 'non-money.' I argue that such a view can be successful only, if following traditional essentialism, there is a set of intrinsic properties that are necessary and sufficient for membership in the natural kind designated by the term 'money.' However, based on what is currently known by monetary economists, there is neither set of intrinsic properties nor necessary and sufficient characteristics that one could use to separate 'money' unambiguously from 'non-money.' Thus, I claim that there is nothing in the nature of money that can be interpreted as a natural kind essence.

The multiple objects that are accepted in trade differ in their degree of liquidity. Since there is no absolute standard of liquidity, the difference among distinct objects does not become a difference in kind and remains a difference in degree. Thus, economists draw the dividing line among assets in a point that is convenient for a given purpose: testing a hypothesis, building a simplified model, predicting a phenomenon, designing a policy, or regulating an activity. Thus, the functional approach that I defend in the thesis agrees with HPC theory that scientists' epistemic interests play a part in deciding the extension of natural kinds.

A limitation of the thesis is that I do not discuss thoroughly the way monetary economists set empirically the boundaries of their categories. Further research interested in fixing such a limitation might require investigating the history of monetary aggregates and the reasons driving divides such as M0, M1, and M2. Of particular importance would be to reconstruct the debates between simple sum monetary aggregates and the Divisia monetary aggregates proposed by Barnett (1980, 1982). The proposal of Barnett is appealing as it claims that the different assets have to be added up with weights reflecting the various degrees of liquidity. Likewise, it would be interesting to study salient episodes in which, when testing a certain generalization (e.g., the neutrality of money), monetary economists had to decide the extension of a category like 'money.'

Once the questions regarding liquidity-based asset classification has been addressed and the fear that economics cannot yield reliable knowledge due to the absence of natural kinds dispelled, the thesis directly engages in the study of liquidity. The thesis contributes to the theoretical study of illegal means of payment with the same models developed by monetary economists. Using the case of a community in which an illegal commodity provides liquidity services, the thesis researches the impact of a government policy on the exchange value of such a commodity in internal trade.

Money is not a new issue in philosophy. At least since Aristotle philosophers have felt that money is a phenomenon so complex that is worth being studied (de Bruin et al., 2018). Lately there has been a revival of interest in discussing the nature of

money, especially among philosophers engaged in the project called *social ontology*. In standard discussions of social ontology, a dollar bill has been the favorite example used by philosophers to organize their thoughts about money. It is not that the case of a dollar bill is uninteresting. Indeed, social ontology has raised a number of important points regarding the role of language, rules, equilibria, and human beliefs in the creation and maintenance of the institution of money from the discussion of hard cash. However, this way of thinking about money leaves out many important issues. As a matter of fact, a great deal of current transactions are not carried out with cash, but with the help of some third-party liabilities such as bank deposits and credit cards. Besides, other financial instruments have acquired an important degree of liquidity, and they can be used to facilitate transactions either directly by working as collateral in credit trades or as a means of payment in monetary trades, or indirectly by being first easily sold for cash. These are all issues that as much as the general topics of credit, liquidity, banking, and financial intermediaries are receiving a lot of attention from monetary economists and policy makers. The thesis thus contributes to the bridging of the gap between monetary economics and social ontology by bringing philosophical scrutiny to bear on liquidity and secured credit. There is no doubt this is just a small step and much work remains to be done.

1.7 Organization of the thesis

The thesis is composed of this introduction and four additional chapters written independently and aiming at different audiences. Chapter 2 presents the monetary approach that largely, although not exclusively, informs the philosophical and economical work developed in the rest of the thesis and should be accessible for both philosophers and economists. Chapter 3 mainly targets an audience of philosophers with an interest in economics, while Chapter 4 mainly an audience of economists with a philosophical sensibility. However, I have attempted in these two Chapters to promote dialogue, to the extent possible, between economists and philosophers by providing the reader with details of concepts and tools employed in each discipline. A consequence of that choice is that the reader may find in these chapters a few repetitions of some definitions. Hopefully I have achieved a good balance between rigor and clarity that will compensate. Chapter 5, in contrast, is an exercise for specialists in monetary economics.

The order of the chapters reflects the breadth that can be found in liquidity. Once the foundations of the economics of liquidity have been presented in Chapter 2, Chapter 3 uses the broadest definition of liquidity, including assets that work as means of payment or collateral and are used via monetary or credit trades. Chapter 4 excludes collateral but keeps means of payments used either via monetary or credit trades. Finally, Chapter 5 excludes credit, focusing on only means of payment used through monetary trades. In line with the idea that philosophy deals with more abstract issues, we thus move from the philosophically-oriented Chapter 3 to the economically-oriented Chapter 5 insofar as we narrow the property of liquidity. Below, I detail the

organization of the thesis.

Chapter 2. New Monetarist Economics: from the positive price of money problem to the liquidity-based approach to asset prices

Building on previous literature on the history of economics, this chapter shows the historical roots and methodological features of the liquidity-based approach to asset prices. The chapter begins by discussing how past economists have sought the integration of money into value theory. The chapter suggests that the failure to explain the positive price of money within the general equilibrium framework may account for the widespread use of shortcuts for money such as money-in-the-utility function (MIU) and cash-in-advance (CIA). The chapter presents these shortcuts, highlighting their historical origins and methodological limitations. Finally, the chapter discusses how a group of monetary economists embraced the so-called Wallace dictum and thus faced the challenge of building a foundational monetary theory. This foundational theory offered an answer to the positive price of money problem. Once the answer was generalized to any asset that facilitates transactions, modern monetary economists developed a liquidity-based approach to asset prices.

Chapter 3. The functional unity of 'liquid assets'

The chapter contributes to the debate about the existence of natural kinds in the social world. The chapter claims that the kind 'liquid assets' is a functionally defined natural kind. The kind 'liquid assets' is united by the functional property of liquidity and such a function can be multiply realized. There are two genuinely different mechanisms through which assets can render liquidity services: monetary trades and credit trades. The kind 'liquid assets' also earns its credential of natural kind by playing an epistemic role in explanatory economic models. Although the kind 'liquid assets' is mind-dependent, such a dependence does not threaten its realism. Therefore, 'liquid assets' can be regarded as a natural kind. An implication is that philosophers must be more cautious before endorsing a dismissive attitude toward the social sciences.

Chapter 4. What do we call money? An appraisal of the money or non-money view

This chapter is co-authored with Gabriel Guzmán, another young scholar from Colombia and currently affiliated at Universidad del Tolima, Colombia. A slightly different version of this chapter has already been published in the *Journal of Institutional Economics*, 2020, Volume 16, Issue 1.

Part of the debate fueled by cryptocurrencies has revolved around the question of what we call money. This chapter identifies two traditions in monetary theory that have tried to answer that question. On the one hand, *the money or non-money view* follows a strategy proposed by a version of philosophical essentialism, in which there is a set of defining characteristics of money that make it categorically different from other things used in transactions. On the other hand, *the liquidity degree view* emphasizes

that the multiple objects that circulate as a means of payment differ in their degree of acceptability. Since there is no absolute standard of liquidity, a precise dividing line between money and non-money cannot be drawn. The chapter challenges *the money or non-money view,* arguing that there is nothing in the nature of money that can be interpreted as a natural kind essence by which money can be categorically separated from non-money.

Chapter 5. Coca-base money: exchange value and anti-narcotics policy

In coca-growing regions of Colombia, coca-base is widely used as a means of payment. Coca-base is an input for final cocaine, thus its production is part of an illegal activity. This chapter develops a theoretical search model in which both coca-base and official currency circulate as means of payment. In the model, coca-base and official currency are indivisible assets but agents bargain over the quantity to be produced in trade. The model shows that an increased probability of suffering a seizure lowers the exchange value of coca-base, which also leads to a reduction of the search intensity, the production intensity, and the stock of coca-base produced by the economy. While the fall in the production of inputs for cocaine is a result already pointed out by the literature on drug-trafficking, the novelty of this model is that it proposes a different mechanism through which the anti-narcotics policy can affect the production of coca-base: the exchange value of coca-base in internal trade.

Chapter 2

New Monetarist Economics: From the Positive Price of Money Problem to the Liquidity-based Approach to Asset Prices

2.1 Introduction

Money has been an elusive subject in economics. It is remarkable that while money in many ways seems indispensable in performing a great number of day-to-day activities, in a core economic paradigm such as the Walrasian general equilibrium theory, money makes no difference in the economic outcomes that agents can achieve. Questions such as 'why do we use money?', 'under what conditions money is positively valued?', and 'when money does expand our ability to attain better outcomes' turned out to be difficult to answer within the value theory that standard economists devised to explain the working of competitive markets. After considerable efforts, economists not only came with a number of distinct ways to address the above questions but also developed certain attitudes towards the subject of money.

The attitudes towards money can vary greatly among economists. However, for Kiyotaki and Moore (2001), there are at least three distinguishable groups. A first group believes that money does not matter and thus may claim, for example, that models without money are well-suited for the study of monetary policy (Woodford, 1998). A second group believes that money is important for the understanding of economic policy and the managing of the economy. However, this group is satisfied with models that impose the use of money through a shortcut. The third group, in contrast, cares about the foundations of money and thus believes that the study of monetary issues has to be done with models that explain the use of money rather than imposing it. In this chapter I focus on the third group of economists. In particular, I offer a brief reconstruction of the historical roots and the methodological characteristics of the so-called *New Monetarist Economics* (NME), with a special emphasis on the positive price of money problem and the development of a liquidity-based approach to asset prices. This reconstruction does not intend to be historically and methodologically exhaustive. I rely heavily on existing literature in the history of economic thought, as well as on available surveys about NME. The rest of the thesis largely borrows from models and results produced by NME. Thus, before we move to the other chapters, it is useful to gain first a better understanding of the main characteristics of this particular approach to money and liquidity.

The chapter is organized as follows. In section 2.2, I present a historical background of the so-called positive price of money problem. In section 2.3, I introduce the most popular shortcuts to money: money-in-the-utility function and cash-in-advance. In section 2.4, I discuss Wallace's dictum and its implications for NME. The essentiality of money and the development of a liquidity-based approach to asset prices is presented in section 2.5. Finally, I present a conclusion in section 2.6. I also remark that throughout this chapter, I understand money as an object that works as a means of payment in a *quid pro quo* trade.

2.2 The positive price of money problem

Monetary theory at the end of the last century was perceived to be in an unsatisfactory state. Hellwig (1993, p. 215) expressed his concern that 'we do not yet have a suitable theoretical framework for studying the functioning of a monetary system'; and Banerjee and Maskin (1996, p. 955), in a crude depiction, claimed that '[m]oney is something of an embarrassment to economic theory.' The difficulties in achieving the integration of monetary and value theory, an endeavor that has its roots in Walras and that extended well into the twentieth century, largely explains such dissatisfaction with monetary theory.[17] The basic premise of the theoretical endeavor for integrating both theories is described by Ostroy (1987, p. 6737) as so:

> The presumption in this integration of money into value theory is that monetary theory is the weak partner and that by the exercise of reshaping it to fit the more rigorous choice-theoretic principles of value theory, including capital theory, monetary theory will be strengthened.

Therefore, money was initially thought in the Walrasian general equilibrium tradition as an accessory issue (Benetti, 2004; Ostroy, 1987). In a first stage of research, value theory had to determine the equilibrium values of relative prices in the real sector. Only in a second stage, monetary economists could then find the value of absolute prices in the monetary sector. This subordinate role of monetary theory with respect to value theory was the subject of intense debate among monetary economists during a great part of the twentieth century. But specially from Patinkin's (1965) pioneering work, monetary economists became increasingly aware of the complications associated with introducing money merely up to a second stage, as well as constructing a monetary theory in line with the principles of value theory.

Patinkin (1949; 1950-1951; 1951; 1965) opposed the real-monetary dichotomy. He not only questioned the consistency of such a dichotomy, but showed that once the inconsistency was solved, traditional analysis left absolute prices indeterminate.[18] Patinkin noted, for example, that the excess demand function for money assumed in the second stage was not consistent with the degree of homogeneity assumed in the first stage.[19] Although one way to solve the inconsistency would be to simply assume a homogeneous excess demand function of degree one in the second stage, Patinkin showed that such a solution only created further difficulties. Consider an economic system initially in equilibrium. If all absolute prices double, the result will be that the relative prices will remain unchanged and the goods market will continue to be in equilibrium. Additionally, by Walras' Law, the money market is expected to be in

[17] For a more detailed presentation, see Ostroy and Starr (1990) and Gale (2008).

[18] Patinkin initially directed his attack towards the so-called classical monetary theory (Patinkin, 1949). Afterwards, he pointed out that the dichotomization also had 'neoclassical roots' (Patinkin, 1965, p. 174). This was a source of controversy since some economists claimed that the real-monetary dichotomy could not be attributed to certain classical and neoclassical economists (Becker and Baumol, 1952). In order to avoid entering such controversies, I have here privileged the use of the term traditional analysis.

[19] See the proof in Patinkin (1949).

equilibrium, too. However, as Patinkin noted, all absolute prices doubled and there are no forces in the system to bring them back to the initial level. Thus, the new set of absolute prices must be considered an equilibrium set as well. More generally, any multiple ζ of the initial set is also a set of equilibrium absolute prices. Accordingly, the absolute price level in the traditional analysis remains indeterminate. In Patinkin's (1951, p. 134) words:

> The main conclusion of this analysis was that the classical attempt to dichotomize the economic processes of a monetary economy into a real sector, dependent upon and determining relative prices, and a money sector, dependent upon and determining absolute prices, cannot possibly succeed. In particular, it was argued that this dichotomized theory is either inconsistent or, at best, indeterminate in the absolute prices.

Research on the existence of a general equilibrium ran parallel to some of the aforementioned debates. Patinkin's first edition of *Money, Interest and Prices* came out in 1956. Two years before, Arrow and Debreu, as a result of a collaborative work carried out within the Cowles Commission, had published their influential article *Existence of an Equilibrium for a Competitive Economy*. Later, in 1959, *Theory of Value* by Debreu was published, a work in which Debreu offered a demonstration of the existence of equilibrium that 'constitutes a definitive step for the theory of general equilibrium' (Cot and Lallement, 2006, p. 385). This was until 1962, during a conference held at Royaumont Abbey, France, when Hahn (1965, p. 126) presented a paper that aimed to shorten the distance separating monetary theory from the general equilibrium theory:

> Recent work on the existence of an equilibrium has been concerned with a world without money while all work in monetary theory has ignored the 'existence' question. In this paper I propose to investigate some of the problems of rectifying this omission.

For Hahn (1965), the proof of the existence of a general equilibrium in an economy with fiat money had to offer an answer to the question about how the price of money is determined and in particular about the conditions under which money displays a positive price in equilibrium. In this regard, Hahn explicitly established the positivity of money price as a problem of monetary theory. [20] Though money can provide a useful service lubricating exchanges, this does not guarantee a non-zero price of money; nor does it ensure a positive demand for money. Whenever the price of money falls to zero, agents can no longer buy goods with such a money as nobody would accept it in trade. For money to play a role in transactions, it must display a positive price, or as Starr (1989, p. 295) put it, 'Positivity is a necessary condition for usefulness.' Hahn (1965, p. 128) then examined the results of Patinkin's monetary model regarding the price of money and concluded:

[20] The positive price of money problem is also known as the *Hahn problem*. In contrast, the *modified Hahn problem* has to do with the coexistence of money with interest bearing assets.

> We are told that the demand for fiat money depends on its exchange value [...]. It follows that no money will be demanded if its exchange value is zero. [...] We therefore reach the rather displeasing conclusion, that the Patinkin model always contains a "non-monetary" solution.

Monetary economists spent a great deal of intellectual energy on addressing the positive price of money problem. Innovative work was conducted, multiple ways were explored, and the results achieved are still a matter of discussion. Providing a detailed presentation of all these efforts is beyond the scope of this chapter.[21] Still, I want to remark that as the difficulties in finding a positive price for money in a Walrasian general equilibrium economy became more evident, mistrust in the ability of this framework to account for money deepened. As Hahn (1983, p.1) summarized, 'the most serious challenge that the existence of money poses for the theorist is this: the best developed model of the economy [the Arrow-Debreu model] cannot find room for it.'.

2.3 Shortcuts for money

The above difficulties might help explain the widespread use of shortcuts for money in monetary economics. Some economists think that these shortcuts are useful because they allow one to investigate important macroeconomic issues. However, they share a weakness: they leave aside the question of why money has a positive price in trade. Instead of discussing the reasons money is accepted in transactions, a demand for money is simply presupposed. The most popular shortcuts available in the literature are money-in-the-utility function (MIU) and cash-in-advance (CIA).

2.3.1 MIU

Historians of economics have traced back the roots of MIU to Walras (Bridel, 2002). While discussing Walras' monetary theory would take us too far afield, having a look at Walras' ultimate 1900 monetary model does permit us to appreciate the longstanding presence of the MIU shortcut in monetary theory.[22] After having made changes in the time structure of his model, Walras believed that he had found room for money in the utility function. Following Bridel (1997), it is possible to think of Walras' last

[21] These attempts include overlapping generations models (Samuelson, 1958; Wallace, 1980), models in which agents' expectations back the price of money (Grandmont, 1974), models that employ institutional arrangements (Starr, 1974), models of spatially separated agents (Townsend, 1980), search models of money (Kiyotaki and Wright, 1989; Iwai, 1996), and trading post models (Starr, 2012). Benetti (1996) provides an insightful discussion about the Hahn problem. See also Álvarez and Bignon (2013) for an updated and comprehensive history of the debates in monetary theory. A heterodox view called Cartalism has explained money as a creature of the State, so that the price of money does not fall to zero because money is useful to pay taxes (Bell, 2001; Wray, 2014a). Another alternative is Goodhart (1998) who explains the value of money as a result of a combination of trust and authority.

[22] Walras' ideas on money are still subject of different interpretations and controversies. See for example Rebeyrol (1999), Arena and Gloria-Palermo (2008), and Álvarez and Bignon (2013).

monetary model as proceeding through three phases.[23] In a first phase, a *tâtonnement* mechanism is used to ensure that equilibrium prices are reached at once and for all markets. Later, in a second phase, the delivery of goods begins and agents must pay for them in money on fixed dates. In other words, from the first phase agents know exactly both the amount of payments they will make and receive during the second phase, and the exact date when these payments will occur. That is, agents know how much money they must hold to cover potential time lags among expenditures and revenues. Money is thus not a good that generates utility in and of itself. Instead, it yields utility as 'its possession allows consumers and entrepreneurs to bridge the fully anticipated future gaps between expenditures and receipts' (Bridel, 2002, p. 272).

This way of introducing money is not without problems (Bridel, 1997, 2002). First, Walras, like modern theorists of general equilibrium, could not prove the superiority of monetary exchange over barter exchange. As Ostroy and Starr (1990) mention, the introduction of money in the utility function does not prove that money has a special role to play in transactions. We could conceive of optimal endowment allocations in which individuals do not have an incentive to trade, and thus holding money does not generate any utility. Second, Walras' model provides no reason to explain why an individual between the first and second phases prefers to hold unproductive cash balances over interest bearing assets. These flaws show that Walras' last monetary model cannot successfully account for the transactional role of money. The presence of money in the utility function is simply presupposed. Bridel (1997, p. 119, italics in the original) described it as follows:

> Walras already found it difficult to build a model that formally explains why money is used in transactions when it is dominated as a store of value. [...] Consequently, and like most modern theorists, Walras took a short cut and started with the assumption that money *must* be used in some transactions.

Without going into specifics, Walras' intuition was recovered later by Hicks (1935) and Patinkin (1965). The latter, in particular, included real balances in the utility function with the aim of breaking the indeterminacy of monetary prices in traditional analysis. Based on Patinkin's model, Sidrauski (1967) proposed a model to connect monetary theory with long-term issues such as economic growth and capital accumulation.[24]

The utility function of a representative household in this model is assumed to be:

$$U_t = u(c_t, m_t)$$

where $c_t \equiv \left(\frac{C_t}{N_t}\right)$ is time t per capita consumption, $m_t \equiv \left(\frac{M_t}{P_t N_t}\right)$ is real per capita money holdings, N_t is the population, M_t is the stock of money, and P_t is the price level.

[23] Since a role for money is defined in the first two phases, I disregard the third one.

[24] The presentation of Sidrauski (1967) and Svensson (1987) model, the latter for the case of CIA, is based on Walsh (2010) and Jensen (2015).

The representative household seeks to maximize lifetime utility

$$W = \sum_{t=0}^{\infty} \beta^t u(c_t, m_t), \tag{1}$$

where $0 < \beta < 1$ is a subjective rate of discount. The representative household chooses time paths for consumption and real money balances subject to the following budget constraint expressed in per capita values

$$f(y_t) + \tau_t + (1-\delta)k_{t-1} + \frac{1}{1+\pi_t} m_{t-1} = c_t + k_t + m_t, \tag{2}$$

where y_t is the aggregate output, τ_t represents net transfers received from the government, k_{t-1} is the aggregate stock of capital at the start of period t, δ is the depreciation rate of physical capital, and $\pi_t \equiv \frac{(P_t - P_{t-1})}{P_{t-1}}$ is inflation. It is assumed that the population growth is 0 and $N_t = 1$. The households' total available resources at period t denoted by ω_t are:

$$\omega_t = c_t + k_t + m_t. \tag{3}$$

The household's problem is to choose c_t, k_t, m_t to maximize (1) subject to (3). Thus, the marginal rate of substitution between money and consumption is

$$\frac{u_m(c_t, m_t)}{u_c(c_t, m_t)} = \frac{i_t}{1+i_t} \equiv \gamma_t. \tag{4}$$

Equation (4) can be interpreted as the opportunity cost of holding money, which is directly related to the nominal interest rate i_t. Hence, it is expected that an increase in i_t, given a level of consumption c_t, leads to a fall in the real demand for money m_t.

This system can be extended both to study the steady-state equilibrium and to examine the dynamic behavior of the economy. The model often displays neutrality and superneutrality of money, thus providing conclusions on the impact of money growth on the economy. Likewise, the model permits economists to analyze the welfare costs of inflation and to derive implications on the optimal quantity of money. Though this information can be valuable in guiding policy-making, it must be noted that from the outset money is simply presupposed. In equation (1), money holdings represent one of the arguments of the household's utility function. Agents derive utility directly from the very act of holding money. Unlike Walras' ultimate monetary model, the MIU modern approach postulates that money generates utility even if it is never used to purchase goods. Thus, we are left with the conclusion that agents hold money because it yields utility in and of itself—although we lack an explanation as to why money does this. Money is simply grafted in the utility function by appealing to a shortcut. This point is recognized by Walsh (2010, p. 52):

> In the MIU model, there is a clearly defined reason for individuals to hold money—it provides utility. However, this essentially solves the problem of

> generating a positive demand for money by assumption; it doesn't address the reasons that money, particularly money in the form of unbacked pieces of paper, might yield utility. The money-in-the-utility function approach has to be thought of as a shortcut for a fully specified model of the transaction technology faced by households that gives rise to a positive demand for a medium of exchange.

2.3.2 CIA

MIU is certainly not the only way to rationalize a role for money. In the midst of the controversy unleashed by Patinkin's work, Brunner (1951) pointed out that it was possible to obtain a positive demand for money without the need to use money as an argument of the utility function. Instead, Brunner argued in favor of introducing a second constraint to the utility maximization process. Thus, monetary theorists' analytical interests shifted from the utility function to choice alternatives described by the budget constraint. This is the route explored by Clower (1967) in formulating the CIA constraint.

Clower's (1967) analysis is driven by an empirical concern. For him, the description of the economic system proposed by monetary theory must correspond with the functioning characteristics of a monetary economy. In this regard, Clower (1967) noted that the conception of exchange embedded in Patinkin's theory was not consistent with a monetary economy's properties. Instead of providing a description of monetary exchange, monetary theory ended up modeling a system with the features of a barter economy. In particular, Clower (1967) claimed that the traditional budget equation did not preclude trade between any combination of goods in the economy. Any commodity, regardless of whether it was money or not, could be directly used in trade to acquire another. The model thus did not distinguish analytically between money and the rest of goods in the economy. Money performed no special role in transactions that made it different from other goods. In Clower's words (1967, p. 3):

> The answer to our query about the appropriateness of the budget constraints of established theory as a description of choice alternatives in a money economy is negative; what presently passes for a theory of a money economy is in truth descriptive of a barter economy.

The solution for Clower was to draw a sharp distinction between money and non-money commodities by assigning a special role to the former. Such a role could be captured by requiring that money had to be traded directly for all other commodities. Money must be involved (offered or demanded) in each exchange relation in the economy. This is the idea expressed in Clower's (1967, p. 5) aphorism: 'Money buys goods and goods buy money; but goods do not buy goods.' Building on this, Clower formulated what would later be known as the CIA constraint, which would also have a profound impact on the development of macroeconomic models (Lucas, 1980; Lucas and Stokey, 1983, 1987).[25]

[25] For a detailed discussion of Clower's microfoundations of monetary theory, see Plassard (2017).

As a first approach to the way the CIA constraint works, consider Kohn's (1981) economy in which it is assumed a household with two members: a worker and a shopper. The worker spends the week working in a shop that produces a single good and gets paid for the labor at the end of the week. The shopper, in contrast, spends the week purchasing the goods needed by the household. Since all purchases must be paid with money, the household's planned expenditures are limited by the amount of money on hand at the beginning of the week. That is, in addition to the traditional budget equation, a CIA constraint is imposed on a household's choice alternatives.

I introduce now a version of the Svensson (1987) model with certainty. A representative agent has the following utility function:

$$\sum_{t=0}^{\infty} \beta^t u(c_t), \tag{5}$$

where $0 < \beta < 1$. The maximization process is subject to a budget constraint ω_t and a CIA constraint

$$\begin{aligned} \omega_t &\equiv f(k_{t-1}) + \tau_t + (1-\delta)k_{t-1} + \frac{m_{t-1} + (1+i_{t-1})b_{t-1}}{1+\pi_t} \\ &= c_t + k_t + m_t + b_t, \end{aligned} \tag{6}$$

where b_t stands for real bond holdings per capita and the rest of variables denote the same as in the above MIU model. There are two types of markets, asset markets and goods markets. Supposing that the goods market opens first, the CIA constraint on consumption goods is

$$c_t \leq \frac{m_{t-1}}{1+\pi_t} + \tau_t. \tag{7}$$

Now the household's problem is to choose c_t, k_t, b_t, m_t to maximize (5) subject to equations (6) and (7). Then the first order condition for consumption can be expressed as

$$u_c(c_t) = \lambda_t(1 + i_{t-1}). \tag{8}$$

where λ_t is the marginal value of wealth. A positive nominal interest rate raises the marginal cost of consumption above the marginal value of wealth. Consequently, for CIA a positive nominal interest is equivalent to a consumption tax.[26]

The CIA model, in comparison with MIU, can be regarded as a step forward. The CIA model does not suppose that an individual derives utility directly from holding money. Money yields utility indirectly through goods that agents can purchase with money. The CIA model manages to depict the hallmark of the monetary economy, i.e., the fact that money is widely used in exchange. However, this step forward

[26] As in the case of MIU, we could keep developing the model to derive further practical implications about monetary policy.

is not achieved by deriving endogenously the conditions that lead agents to use money in trade. Instead, it is done by taking a shortcut; the model imposes an additional restriction (see (7)) to ensure that money is used. Thus, in CIA we lack an explicit formulation of the reasons for which monetary exchange is decided by agents. Commenting on these limitations, Kiyotaki, Lagos, and Wright (2016, p. 2) pointed out:

> Other work imposes the restriction that agents cannot trade A for B, but must first sell A then buy B with cash. While this may be realistic, it is a failure for monetary economics to have this as an assumption rather than a result. It is also unnatural to build monetary theory on a foundation where money hinders rather than helps economic activity. [...] Now, one could tell stories around these shortcuts—e.g., some agents might not be able to meet directly—but why not put that explicitly in the model?

2.4 A dictum for monetary theory: the foundations of money

In a methodologically-oriented essay, Wallace (1998, p. 21, italics in the original) set out a dictum for monetary theory: '*Money* should not be a primitive in monetary theory—in the same way that *firm* should not be a primitive in industrial organization theory or*bond* a primitive in finance theory.'[27] A theory that forces the use of money through the imposition of restrictions and *ad hoc* assumptions is treating money as a *primitive*.[28] Such a theory presupposes the use of money as a given building block of the system and thus leaves unexplained the reasons that give rise to that building block. In clear contrast, a theory that satisfies the dictum seeks to obtain a demand for money as a result of the explicit modeling of agents' decisions. In applying Wallace's dictum to the theories discussed in the last section, I conclude that approaches taking shortcuts do not meet it. As noted above, MIU assumes that something called money is one of the arguments of the utility function and CIA imposes an additional constraint to find a role for money. Both approaches neglect the inquiry into the foundations of monetary exchange. Consequently, if one is interested in discussing such foundations, MIU and CIA cannot provide us with answers.

Wallace's dictum requires monetary theory to start by clarifying the motives that lead individuals to decide to use money. However, as mentioned above, for money to be accepted in trade money must display a positive value. In that sense, the Wallace's dictum also implies to tackle the positive price of money problem. Under the

[27] Wallace's essay was originally published in Medema and Samuels's 1996 book and then reprinted in 1998 by the Federal Reserve Bank of Minneapolis. Since this last version is what is widely cited by economists, I decided to keep the reference to this version.

[28] Economists build theoretical models from a set of assumptions and axioms whose validity can be taken for granted. Such assumptions and axioms are often referred to as primitives. Because they are not explained by the model, but are presupposed, their justification requires employing arguments external to the model whether derived from the scientific findings of other disciplines or simply from an observation of a real-world feature. Technologies, preferences, and endowments are often the primitives of a standard economic model.

pressure of Wallace's dictum, monetary theory is pushed down one level and monetary economists are tasked with describing the fundamental conditions that make it possible for trade to take place with money. Regarding this theoretical challenge, Wallace (2001, p. 849) claimed,

> Tastes and technologies are given building blocks of economic models mainly because the assumed descriptions can, in principle, be provided by other disciplines. Agronomists describe the various ways to grow wheat, chemists describe how molecules are constructed, and so on. But no other discipline will tell economists how real cash balances contribute to utility or reduce time spent shopping or what constitutes those real cash balances.

To put it in the words of Thomas Sargent (2015, p. 49, italics added), 'Wallace thinks monetary economics is important and that we should be patient enough to construct a monetary theory from *first principles*.' Wallace's dictum thus establishes a criterion for normatively judging existing monetary theories according to their ability to inform on the foundations of monetary exchange. That is, the dictum became an attribute that some theories possess and others lack.

Today, a group of monetary economists have explicitly endorsed Wallace's dictum. This group introduces itself as representing a novel monetary school, so-called *New Monetarist Economics* (NME). For NME's members, the reference to Wallace's dictum is not intended to justify a circumstantial modeling preference, but instead to signal a distinguishing feature of their school. NME embraced Wallace's dictum to the point of elevating it to the rank of a guiding principle. In contrast to what is accepted in MIU and CIA, NME works on deciphering both the functioning and the nature of monetary phenomena through models that generate an endogenous money demand. Williamson and Wright (2010a; 2010b), two leading NME members, identified five principles that serve to distinguish New Monetarists from an Old Monetarists and a New Keynesian economists. The second of these principles says the following:

> Principle 2. Money matters, and in the quest to understand monetary phenomena and monetary policy, it is decidedly better to use models that are explicit about the frictions that give rise to a role for money in the first place; as Wallace (1998) puts it, *money should not be a primitive in monetary economics* (Williamson and Wright, 2010a, p. 267, italics in the original).

The logical consequence of establishing this key principle is unsurprising. Models employing shortcuts for money had to be rejected in favor of theories in which the use of money is not presupposed. This was exactly what New Monetarists did. The above principle marked a crucial difference between their own theoretical preferences and those practices accepted by monetary economists working with shortcuts. Models that impose CIA constraints, or use MIU, or that simply have no money, clearly violated the Wallace dictum and therefore had to be rejected. For instance, Rocheteau and Nosal (2017, p. xviii) vindicated their refusal of MIU and CIA in terms of the non-satisfaction of Wallace's dictum, 'Following Wallace (1998, 2001, 2010), we believe a reasonable

modeling goal in the study of money, or any payment instrument, is that it be essential. None of the approaches described above satisfy the so-called Wallace (1998) dictum.'

Furthermore, to the extent that NME developed a family of monetary models with several generations and accumulated results that could be contrasted with those generated by competing approaches, the dictum was also used to emphasize a positive property of their approach. Regarding methodological practices, NME's members have recognized that 'our preference for modeling monetary, credit and other such arrangements explicitly is related to the Lucas (1976) critique, ideas espoused in Townsend (1987a, 1988), and the Wallace (1998) dictum' (Lagos et al., 2017, p. 375). Accordingly, the Wallace dictum was not merely invoked to discard rival theories, but did its part in strengthening the development of a new modeling preference.

2.5 The essentiality of money and liquidity-based approach to asset prices

The positive price of money problem was not the only challenge for the construction of a foundational theory of monetary exchange. Hahn (1973, p. 231) showed that money played no *essential* role in Walrasian general equilibrium models: 'there is nothing we can say about the equilibrium of an economy with money which we cannot also say about the equilibrium of a non-monetary economy.' To remedy this limitation, Hahn (1973) advised that the foundations for monetary exchange had to be sought in models in which the use of money allowed the agents to attain economic outcomes that would otherwise not be achievable. These models, by showing an essential role for money, could demonstrate the superiority of monetary exchange and elucidate the reasons as to why agents decide to use money. Put another way, monetary economists had to investigate the positive price of money problem in models where money would play an essential role.[29]

NME has used extensively search models of money with trading frictions, i.e., factors or circumstances that inhibit trade between agents, to address the essentiality of money and the positive price of money problem (Lagos et al., 2017).[30] The Arrow-Debreu model depicts a centralized exchange mechanism, and consequently it lacks a description of the exchange process among agents. In a competitive equilibrium of a frictionless economy, all trades take place on the same date and in the same market. That is, agents reach a once-and-for-all trading arrangement (Ljungqvist and Sargent, 2012; Rogers, 2008). This *centralized* representation of the economy leaves no room for money. NME therefore developed models of *decentralized* trade that on the one hand

[29] NME's members have claimed: 'Monetary theorists are concerned with, perhaps more than anything else, the essentiality of money' (Lagos and Wright, 2008, p.1). For Álvarez and Bignon (2013), the perspective of essential money can be regarded as opposed to the endeavor for integrating value theory and monetary theory. In this respect, they (2013, p. 111) hypothesize that monetary theory might have stopped being the 'weak partner' of the Walrasian price theory to acquire its own autonomy scientific.

[30] Note that search models of money are not the only ones that satisfy Wallace's dictum. For example, overlapping generations models also do.

describe explicitly who trades with whom and how, and on the other hand contain frictions which money helps overcome. Since money contributes to remedying these frictions, agents are able to accomplish economic outcomes that would be unavailable in money's absence. This essential characteristic of money makes individuals decide to use money in trade, and thus there is no need to impose a role for it. Models of essential money do satisfy the Wallace dictum.

Therefore, NME was able to develop models in which where money is both essential and positively valued. In early models of NME, agents are specialized in the production of different goods and meet bilaterally at random, which results in a particular type of friction. When two agents meet, what one wants to sell is not necessarily what the other wants to buy. Although both agents wish to benefit from trade, a barter exchange cannot occur. Agents could thus use money to overcome the double coincidence of wants problem. However, further research showed that the absence of double coincidence of wants was not sufficient to render money essential (Kocherlakota, 1998). Agents could overcome the absence of a double coincidence of wants by using a pure credit system in which agents either commit to repay their obligations or have perfect monitoring to punish defaulters. Thus, other frictions had to be considered, especially those limiting the use of a pure credit system based on either cooperation or punishment. The key additional trading frictions that give rise to a role for money are *limited commitment* and *imperfect monitoring* (Rocheteau and Nosal, 2017). Thus, specialization in the production of goods and services makes barter an inconvenient transaction mechanism, while limited commitment and imperfect monitoring block a pure credit economy. Agents decide to use money and value it positively because money allows them to benefit from trade while overcoming frictions that inhibit the operation of alternative transaction mechanisms such as barter and a pure credit system.[31]

Apart from establishing the conditions under which money is essential and positively valued, NME is also interested in having models amenable to address policy and macroeconomic questions. The achievement of such a purpose implied the development of several generations of models. The first generation is represented by the Kiyotaki and Wright (1989) model which pioneered the use of search theory to obtain an endogenous role for money. However, a serious limitation of this model is that both assets used as money and quantities traded are not divisible, making the model not amenable to study phenomena like inflation. A second generation of models was developed by Shi (1995) and Trejos and Wright (1995) who relaxed the assumption of indivisible goods and let agents bargain on terms of trade. However, a major breakthrough in NME occurred when the third generation of models was launched by Lagos and Wright (LW) (2005) who offered a tractable model of both divisible goods and divisible money. The LW model brought some competitive markets back by alternating a decentralized market, where money is essential, with a centralized market, where agents balance their monetary holdings. The inclusion of a centralized market

[31]Since commitment is limited and monitoring is imperfect, agents can use credit arrangements other than pure credit system. For a survey of NME models where money and credit are essential, see Mattesini (2019).

made the LW model compatible with the neoclassical growth model, thus integrating the pure monetary theory with mainstream macroeconomics. Since then the LW model has been used to study a wide range of subjects such as welfare costs of inflation, optimality of monetary policy, competing currencies, mechanisms of monetary policy, settlement and payments, exchange rates, firm entry and unemployment, and asset price dynamics (Lagos et al., 2017). In the NME literature today, the LW model is regarded as the workhorse model of monetary economists.

As NME developed the distinct generations of models, a crucial result achieved to the case of money was extended to other assets. The positive price of money was initially investigated in models where a single asset is used as money. However, in actual market transactions many assets can facilitate exchange and not only by working as a means of payment. A Treasury bond, for example, can be used as collateral for an investor who asks a line of credit with the purpose of undertaking a new project. Either as a means of payment or collateral, assets can support our ability to trade. According to NME's models of first generation, the value of money in equilibrium is pinned down by the fundamental value of the asset and the liquidity value arising from the services that the asset renders in facilitating exchange.[32] However, if such a result can explain, for instance, why fiat currency is positively priced in trade despite having zero fundamental value, then the price of any other asset that to some degree facilitates exchange could also be influenced by liquidity considerations. As Wright (2018, p. 117) pointed out,

> Thus liquidity gives currency a price above its fundamental value of 0 in monetary equilibrium. But wait—if currency can be valued in excess of its fundamental due to liquidity, is that also true of other assets? Yes. Any asset that conveys liquidity can have a 'moneyness' about it [...].

Therefore, NME proposed a *liquidity-based approach to asset prices* in which the value of an asset that is useful in facilitating exchange can depart from its fundamentals as a result of a liquidity premium. For instance, if one assumes that agents in the LW model can use shares as a means of payment when visiting the decentralized market, and the dividend is sufficiently low, then the price of a share can be represented as,

$$p_t = \beta E_t\{(p_{t+1} + d_t)[1 + L(q_{t+1})]\} \tag{9}$$

where the price of share p_t is measured in units of the centralized market consumption good, β is the discount factor, and $L(q_{t+1})$ is the liquidity premium. Clearly, if $L(q_{t+1}) = 0$, shares are traded at the fundamental value. However, since they play a role in

[32] NME has been sometimes criticized on the grounds that it relies largely on individual beliefs to explain the value of money, thus neglecting the role played by institutional and cultural factors in the acceptability of money (see e.g., Bridel (2014)). Some NME models that incorporate social norms and the state in the determination of the value of money are Lotz and Rocheteau (2002), Araujo (2004), Lotz (2004), Goldberg (2012) and the model in Chapter 5 of this thesis. Cartelier (2001) also provides an insightful assessment of search models of money.

facilitating exchange, $L(q_{t+1}) > 0$ and shares trade at a value above their fundamentals (Waller, 2015).

The liquidity premium has been used by NME to rationalize asset prices that cannot be simply explained by appealing to the fundamental value. Lagos (2010), for example, shows that the liquidity premium can explain the equity premium puzzle and the risk-free rate puzzle. If government bonds are perceived as safe assets, then they will be widely accepted as collateral. As government bonds are useful to satisfy liquidity needs, their demand and price will be higher and their return lower. Thus, liquidity considerations drive down the return on government bonds with respect to other assets that are perceived as less liquid such as equity. Likewise, NME has also used the liquidity premium to build models that exhibit asset price dynamics that have been in the center of the economic debate after the financial crisis such as bubbles, booms, and crashes (Rocheteau and Wright, 2013).

2.6 Conclusion

Integrating monetary and value theory was a theoretical endeavor based on the premise that monetary theory was the 'weak partner' of value theory. Thus, the former had to be reshaped according to the principles of the latter. After considerable work in pursuing such an integration, it became more evident the difficulties to introduce money in a Walrasian general equilibrium economy. An alternative to avoid such difficulties is simply to impose the use of a means of payment via a shortcut like MIU or CIA. A reaction against the use of shortcuts for money is synthetized in the so-called Wallace dictum. According to Wallace, monetary economists are tasked with providing an account of the reasons as to why trade takes place with money. Thus, instead of presupposing a demand for money, monetary economics has to be developed from models where the use of money is endogenous. NME has endorsed Wallace's dictum and built a family of models where money is essential and positively valued in trade. Such models rely on search theory and trading frictions to offer a description of the way agents trade each other. Furthermore, once NME established models in which money can be valued by the liquidity services money renders in facilitating the exchange, then NME extended the same pricing mechanism to any other asset that to some degree also provides liquidity services. That the value of an asset can be influenced by a liquidity premium is the basic idea of the liquidity-based approach to asset prices developed by NME.

Chapter 3

The Functional Unity of 'Liquid Assets'

3.1 Introduction

Many of our economic transactions are carried out with the help of bills or coins issued by some country's monetary authority. Despite the popularity of bills and coins in transactions, we can also surely remember situations in which the cash in our pocket was useless and instead we paid, for example, with a debit card. In these simple cases, assets like bills, coins, and debit cards all helped us to trade by working as a means of payment. Another way assets can help us to trade is by serving as collateral. Consider a household that obtains a credit line collateralized by a mortgage and uses it to pay for consumption. Beyond the contractual complexities, the physical house is an asset that works as collateral and allows the household to acquire good and services.

Assets that help us to trade, as in the cases above, provide what monetary economists technically call *liquidity services*. There are multiple dimensions and definitions of liquidity. However, in this chapter I understand liquidity as monetary economists do. In monetary economics, liquidity refers to the *degree* to which assets are useful in facilitating transactions (Lagos et al., 2017). Accordingly, when an asset is called a liquid asset, the intended meaning is that such an asset to some degree facilitates exchange by being accepted in trade either as a means of payment or collateral.

An object is traditionally called money if it performs any of the following functions: means of payment, store of value, or unit of account. Distinct monetary theories have addressed each of these functions, and the emphasis on a given function has arguably changed in different moments of the history of economic thought. Currently, most monetary economists share a special interest in the function of means of payments, which is regarded, among the three, as the primary function (Wallace, 2008). The function of means of payment is clearly part of the definition of liquidity used by monetary economists. However, the advantage of defining liquidity in terms of assets that facilitate transactions rather than simply in terms of assets that are a means of payment is that it allows us to include other assets that, like those accepted as collateral, also help us to trade. Liquidity thus does not rival with the function of means of payment; it is instead a more general way to express a property of assets that to some degree help us to trade.

Liquidity opens the possibility to devise a taxonomy of assets. Economists, for instance, can group and give a name to assets that have reached a given threshold of liquidity. We can then ask about the validity of such a classification: Is liquidity-based asset classification a *natural kind* classification? A natural kind can be generically defined as a group of entities that are lumped together because they share a set of properties, provided that the shared properties do not co-occur by chance but by the operation of some causal mechanism. Unlike spurious kinds, natural kinds are precious because they have inductive and explanatory potential. For instance, the properties of the kind 'copper' can explain why an instance of 'copper' conducts electricity and allow us to infer that a new instance of 'copper' will also conduct electricity.

Monetary economists can use interchangeably terms like 'money' or 'liquid assets'

to name the group of assets that, either as means of payment or collateral, have reached a certain threshold of liquidity. However, for the purpose of the chapter, the term 'money' could do more harm than good as it clashes with the still widespread practice of calling 'money' assets that work only as a means of payment (especially, fiat currency) or that have other functions like unit of account or store of value. To avoid confusion, I use the term 'liquid assets' to designate a group of assets that have achieved a given threshold of liquidity, either as a means of payment and/or as collateral. I use the term 'money' instead to refer to a subgroup which works only as a means of payment.

The chapter contributes to the debate about the existence of natural kinds in the social world. My main claim is that the kind 'liquid assets' is a functionally defined natural kind. I argue that the kind 'liquid assets' is united by the functional property of liquidity and that such a function can be multiply realized. There are two genuinely different mechanisms through which assets can render liquidity services: monetary trades and credit trades. I also argue that the kind 'liquid assets' earns its credential of natural kind by playing an epistemic role in explanatory economic models. I finally point out that mind-dependence does not threaten realism about the kind 'liquid assets.'

A popular strategy among philosophers who seek to demonstrate the social sciences' limited ability to yield reliable knowledge is to attack the possibility of finding natural kinds in the social realm (Ellis, 2002/2014; Guala, 2016a). The chapter shows that 'liquid assets' can be regarded as a natural kind. Thus, an implication is that philosophers must be more cautious before endorsing a dismissive attitude toward the social sciences. Throughout the chapter, I use quotation marks for the terms 'liquid assets' and 'money' when I refer to kinds but not when I consider instances (members) of those kinds.

3.2 Liquidity-based asset classification and theories of natural kinds

In this section, I describe the reasons why a liquidity-based asset classification, whether 'liquid assets' or 'money,' does not satisfy the requirements of standard theories of natural kinds such as traditional essentialism and HPC theory. However, before accepting that kinds of the social sciences fail to be natural kinds, another approach should be considered. I present the main features of the functionalist approach to natural kinds and describe the shift from Old to New Functionalism.

3.2.1 Traditional essentialism and HPC theory

According to the natural-kindhood conditions established by traditional essentialism and HPC theory, liquidity-based asset classification is not a natural kind classification. Essentialism has had an influence on economics. A number of economists have believed that a group of assets can acquire a degree of liquidity so

high that the distinction with the rest of assets will cease to be altogether gradual to become merely a difference in kind (see Chapter 4). However, this classificatory endeavor fails because assets used in payments do not meet the requirements of traditional essentialism. Such assets have no set of interior properties that are necessary and sufficient to unambiguously demarcate the boundaries between both groups of assets. There is nothing in the nature of assets used in transactions that can be regarded as a natural kind essence that one could use to sharply separate assets into distinct kinds.[33]

With respect to traditional essentialism, HPC theory represents a progress in that it is able to extend the theory of natural kinds to categories whose membership is defined through neither necessary and sufficient characteristics, nor interior properties (Boyd, 1999). However, recent work on scientific kinds shows that HPC theory leaves outside important kinds posited by science, among them, functional kinds (Reydon, 2009; Ereshefsky and Reydon, 2015). That is the case of liquidity-based asset classification. In this classification, the boundaries among categories are fuzzy not because some property of the cluster may be absent, as in HPC theory, but because liquidity is a property expressed in degrees. More crucially, HPC theory individuates kinds according to their causal mechanisms. Thus, the presence of myriad mechanisms gives a reason for either *splitting* or *lumping* a putative kind (Craver, 2009). If, for example, two mechanisms explain different properties in the same property cluster, then the cluster should be split in two different kinds. But if the same mechanism explains two putatively different property clusters, then the clusters should be lumped together in one single kind. As we will see below, this represents a problem for the kind 'liquid assets.'

The conclusion that liquidity-based asset classification is not a natural kind classification would be supportive of the view that the social sciences are too severely limited to inform about the nature of their subject matter as there are no natural kinds in the social realm. From an essentialist perspective, Ellis (2002/2014, p. 32, italics added) pointed out that,

> As we move to yet more complex systems, from biological organisms up to ecological or social systems, natural kinds analyses become much less interesting. There are no natural kinds that satisfy the strict criteria applicable to chemical kinds [...], and there are no sets of *intrinsic characteristics* of ecological, economic, social or other high-level systems that could plausibly be used to define appropriate microspecies [...]. Therefore, however successful the sciences of ecology, economics, sociology and the like might be in achieving their aims, we have no good reason to be realistic about the theoretical entities they employ [...]. *The aim of economic theory is not, realistically, to reveal the essential nature of market economies*.

However, as there are kinds in the social sciences that seem to play an important epistemic role in the explanation of social phenomena, it is worth considering an

[33] An earlier contribution to the discussion about essentialism and monetary theory is Mäki (1990; 2009).

alternative before we accept the conclusion that the social sciences cannot be taken seriously. It may be the case that, rather than kinds of the social sciences failing to satisfy the natural-kindhood conditions established by traditional essentialism and HPC theory, these two approaches are not adequate to judge the validity of at least some of the social world's kinds. In contrast to traditional essentialism and HPC theory, a functionalist approach could show that, for instance, the kind termed 'liquid assets' is a natural kind. As well as HPC theory extended the theory of natural kinds to sciences like biology, a functionalist approach could achieve the same regarding kinds identified in social sciences like economics.

3.2.2 Functional kinds: from Old to New Functionalism

Members of a natural kind are grouped together because they non-accidentally share a set of properties. In the case of a functional kind, the members are united by a common *function*, i.e., a property that is defined by a causal role or activity. Brzović (2019) mentions that what connects all the members of a functional kind is that 'the entities in question are grouped together because of something they do, and not because they share similar underlying properties.'

Since there can be multiple ways to perform the common function, members of functional kinds can be very heterogeneous. For example, 'different species of animals can belong to the predator category, such as jaguar, human, rattlesnake, or stork' (Brzović, 2019). The idea that a given function can be *realized* in multiple ways is part of the basic tenets of functionalism about kinds. However, it is also an idea that has been seriously contested by critics of functionalism. In response to these challenges, the functionalist approach has recently experienced innovations that marked a shift from Old to New Functionalism (Buckner, 2015).

During the twentieth century, some philosophers of science imposed a constraint upon the theories produced by the special sciences.[34] The constraint was that for such theories to be accepted, they had to be reduced to physics. A major response to this view was provided by Fodor (1974), a figure associated to Old Functionalism, who argued in favor of the autonomy of special sciences. For him that events belonging to the subject matter of special sciences were also part of the subject matter of physics did not imply the reducibility of special sciences to physics. To substantiate this claim, Fodor (1974, p. 103) pointed out that the special sciences often make interesting generalizations about events whose physical descriptions do not have anything in common. In the rare case in which they do, such descriptions play no significant role for either the truth, interestingness, or degree of confirmation of proposed generalizations.

Fodor (1974) was then defending the Multiple Realizability (MR) thesis. This thesis claims that a particular property Ψ at one level of organization can be realized by a group of distinct properties $\Phi_1, \Phi_2, ..., \Phi_n$ at a lower level of organization. While MR is sometimes construed as a distinguishing characteristic of all existing properties in the domain of the special sciences, it is more widely accepted for functional properties.

[34] Recall that the special sciences are defined as all those sciences above physics, including economics.

Fodor (1974, p. 103) took the case of Gresham's law: *Bad money drives out good money*. If two different commodity monies are used in trade, the law predicts that the one with the highest intrinsic value will gradually vanish from circulation. The category 'money' in Gresham's law designates a functional kind. Fodor is not explicit about what functional property unites the members of the kind 'money.' However, economists usually understand that an object called money in Gresham's law plays the function of *means of payment*.[35] The important point in Fodor's argument is that the function of means of payment has many realizers. Paper bills, cigarettes, gold, silver, stones, shells, cowries, cattle, and cocoa beans are a few examples of objects that have historically performed such a function. In that sense, the kind 'money' can be regarded as a multiply realized kind. Fodor (1974) thus used Gresham's law to voice his skepticism about whether there could be found a disjunction of physical predicates able to cover the multiple realizers of 'money' and also figure in a law of physics. While Gresham's law makes an interesting generalization about monetary exchange, such a generalization is not resulting from any commonality based on a physical description of the distinct realizers.

The choice of Gresham's law was not gratuitous. Not all properties have the same importance. The property of *being five miles from the Eiffel tower* reunites a set of very heterogeneous objects, whose grouping is a spurious kind as it does not have any inductive and explanatory potential. In contrast, properties that form a natural kind allow us to identify groupings that perform well in supporting scientific practices such as inductive inference and explanation. For Fodor, scientific laws are the basis for inductive inference and explanation and thus his criterion to distinguish spurious kinds from natural kinds is that the latter figure in scientific laws and the former do not.

Old Functionalism was challenged by critics who argued that the work of finding genuine cases of MR was not as simple as old functionalists often assumed. Shapiro (2000) set a dilemma for MR in which kinds are *individuated* based on their causally relevant properties.[36] In the first horn of the dilemma, realizers are considered to be genuinely different as they differ in their causally relevant properties. However, if realizers are genuinely different, then they cannot realize the same kind. In the second horn, realizers do not differ in their causally relevant properties and thus are not genuinely different. But if there is no causally relevant difference among the realizers, then they are of the same kind and there is no multiple realization. The dilemma thus

[35] I use the expression means of payment rather than means of exchange because it makes clear that an asset can be used to exchange but also to discharge debts (e.g. taxes). For an introduction to Gresham's law, see Dutu, Nosal, and Rocheteau (2005).

[36] I will address Shapiro's dilemma from the perspective of the *individuation* of kinds as I think that is the main concern of his dilemma. However, a related issue is that of the *projectability* of multiply realized kinds, namely, the ability of a multiply realized kind to support scientific generalizations. Such an ability can be questioned by arguing that the presence of multiple realizers may not provide the higher-level kind with stability enough to ground an important range of generalizations. Here I do not get into neither the conceptual debate about where such stability may come from, nor the empirical debate about whether generalizations allowed by a multiply realized kind are limited or not. For a recent discussion about the projectability of multiply realized kinds, see Godman (2015).

implies the following. On the one hand, there is a reason in the first horn to *split* the realized kind into multiple kinds that track causally relevant differences of the realizers. On the other hand, there is a reason in the second horn to *group* realizers into a single kind (Polger and Shapiro, 2016).

Shapiro's dilemma for MR can have two interpretations. One interpretation regards it as a *conceptual* challenge to the very possibility of MR, while the other regards it rather as an *empirical* challenge to the evidence of MR. On the conceptual interpretation, Shapiro's dilemma succeeds in denying the very possibility of MR only because both the realized kind and the realizers are individuated as if they had the same causally relevant properties (Booth, 2018). However, there is no *a priori* argument to assume such a statement. Shoemaker (2007), for instance, has offered an account of property-realization that individuates properties according to their causal profiles but does not preclude the result of MR. A causal profile consists of the backward-looking and the forward-looking causal features of a property. The former are the possible causes of the instantiation of the property and the latter are the possible effects its instantiation contributes to. Thus, for instance, a backward-looking causal feature of the property of *being a tsunami* is that tsunamis are caused by earthquakes, while a forward-looking causal feature of the property of *being magnetic* is that magnetics objects attract iron (Tiehen, 2014). In a case where P and Q are properties instantiated by the same object, Shoemaker (2007, p. 12) argues that,

> property P has property Q as a realizer just in case (1) the forward-looking causal features of property P are a subset of the forward-looking causal features of property Q, and (2) the backward-looking causal features of P have as a subset the backward-looking features of Q.

To illustrate this argument, we can consider the Figure 3.1. Numbers denote distinct causal features and the letters B and F indicate if the causal feature is backward-looking or forward-looking. In the Figure 3.1, conditions (1) and (2) are satisfied, thus we conclude that Q realizes P.

The account proposed by Shoemaker (2007) assigns a relevant causal role to the realized property itself. The realized property P in Figure 3.1 has a causal profile of its own that, while closely related to the causal profile of its realizer Q, is still different. As Shoemaker (2007, p. 13) mentions, his account 'avoids the threat that the causal role of the realized property will be preempted by its realizers.' Therefore, unlike what was found in the first horn of Shapiro's dilemma, Shoemaker's account does not imply that the realized kind has to be split so as to reflect the causally relevant differences of its realizers. Notice, however, that Shoemaker's account does not claim that any property-realization entails MR as there can be properties with only one realizer. But in keeping the possibility of MR open, his account leaves the assessment of MR to be decided on empirical rather on conceptual grounds (Booth, 2018).

New Functionalism developed by Weiskopf (2011), whose title I gratefully borrowed, offers precisely an empirical response to Shapiro's dilemma. He addresses the dilemma by presenting evidence that refutes the first horn. Furthermore, Weiskopf

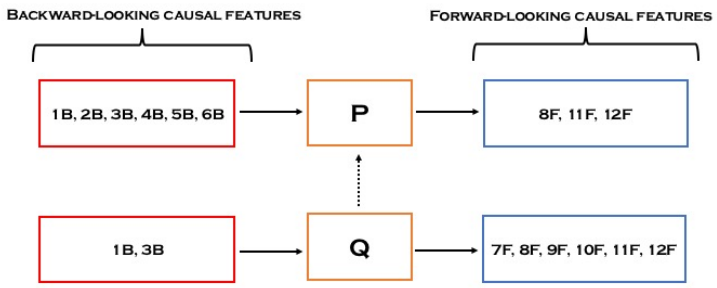


Figure 3.1: Property-realization account adapted from Shoemaker (2007); Tiehen (2014); Booth (2018). Straight arrow stands for causality and dotted arrow stands for realization

(2011) drops the nomological approach to explanation and inductive inference and replaces it with a model-based approach. He also establishes a model-based criterion to judge the validity of kinds formed from a functional property. In the next section, I follow the empirical strategy of New Functionalism.

3.3 'Liquid assets' as a functionally defined natural kind

The kind 'liquid assets' is united by the function of liquidity. However, for a functional kind to count as a functionally defined natural kind, it is needed more than just a grouping seemingly united by a function. It is also needed that the kind in question i-) is a multiply realized kind and ii-) plays an epistemic role in scientific models. This section is devoted to proving that the kind 'liquid assets' meets these two conditions.

3.3.1 Part I: Shapiro's dilemma and multiple realizers

That a kind united by liquidity is a multiply realized kind is not an obvious claim. To see why, we can start with the example used by Shapiro to illustrate the second horn of his dilemma. Shapiro (2000, p. 644) compares two 'waiter's corkscrews,' one composed of steel and the other of aluminum. Both corkscrews serve to remove corks, however, their distinct compositions make no difference to the way they perform the function of removing corks. The capacity of removing corks in both cases is brought about by the same causally relevant property, namely, *rigidity*. Thus, instead of being two different realizers, the waiter's corkscrews of steel and aluminum are identical.

Now let us go back to Gresham's law. Gold and silver are two precious metals that have historically performed the function of means of payment. As they have different chemical properties, they seem to be different realizers of the functional kind 'money.'

However, as critics of Old Functionalism have warned, gold and silver may not differ in their causally relevant properties by which they are used as a means of payment. Despite differences in their chemical compositions, gold and silver could serve as a means of payment in virtue of the *same* causally relevant property: they could perform the function because they are, for example, *durable*. Thus, gold and silver would not be two genuinely different realizers of the kind 'money' and MR would fail according to the second horn of Shapiro's dilemma.

The failure of MR has an important implication. If the kind 'money' is not multiply realized, then it may be argued that rather than being united by something they do, as functionalists believe, members of the kind 'money' are actually grouped together because they share a set of interior properties (e.g., chemical properties that explain the durability). That is, the absence of MR invalids the claim that the kind 'money' is a functional kind. As a consequence, the validity of the kind has to be decided on the grounds of traditional essentialism. But since the difficulties to satisfy requirements of traditional essentialism, we are left with the conclusion that the kind 'money' is *not* a natural kind. This result, of course, would reinforce the confidence of those who think that the social sciences, as cannot identity natural kinds, have only a limited ability to yield knowledge of the world.

Should then we accept that a group of assets united by liquidity is not a multiply realized kind? If we focus on the first horn of Shapiro's dilemma, we should not. Weiskopf (2011, p. 234) recalls that '[w]here there are interestingly different ways of playing the role that defines the property Ψ, then Ψ has different realizations.' We already saw that MR fails when we simply point out that distinct precious metals can be used as a means of payment. However, if we look at the way trades are conducted, rather than on interior properties of assets, we find that assets have two genuinely different ways to play the role of facilitating exchange.

Assets can be used through two distinct transaction mechanisms: *monetary trades* and *credit trades*. A relevant difference between monetary trades and credit trades relies on the settlement period. As Rocheteau and Nosal (2017, p. 197) put it, the key distinction between both mechanisms 'is that monetary trades are quid pro quo, i.e., goods and services are exchanged simultaneously for currency, and do not involve future obligations, while credit trades are intertemporal and involve a delayed settlement.'[37] This relevant difference is, however, related to another difference concerning the motives why assets are in the first place used to facilitate exchange. To present the argument in a simple way, I leave out many of details that characterize a modern system of payments and also use the case of a pure credit economy. The purpose is not to say that such a pure case has ever existed; it is rather a theoretical device to make it clear the relevant differences between monetary trades and credit

[37]There is anthropological and historical evidence that shows that credit trades pioneered the development of monetary trades. In societies such as the Mesopotamian civilization the use of credit occurred long before the invention of coinage and worked on a scale that was much larger than that of the known scale of bartering (Graeber, 2011, p. 21-217). Similarly, domestic and foreign trade were marginal in 7th-6th century B.C. Greece, so the origins of money are instead found in the context of state-religious practices involving debt relationships between men and deities (Semenova, 2011, p. 394).

trades.

Liquidity arises due to what monetary economists call *trading frictions* (Lagos et al., 2017; Rocheteau and Nosal, 2017). These frictions refer to certain factors or circumstances that hinder trade. A well-known friction is *the lack of double coincidence of wants*. Two individuals can barter their goods only if both of them want to consume what the counterpart produces. However, the lack of double coincidence of wants could be remediated by a pure credit economy. Consider a case where individuals produce for one another without receiving any good in exchange, if only because they believe in a promise that someone in the future will do the same for them. If each individual could commit to delivering such a promise, then the economy would be able to circumvent the lack of double coincidence of wants. The same result would be achieved if individuals, instead of relying on commitment, had access to a perfect monitoring technology to punish deviants. As a cheater would be effectively caught and properly punished, the promise is always delivered. In a pure credit economy, based on either commitment or punishment, agents do not default.

In a small society typically with strong familial ties and same shared cultural values, the cooperation may turn out to be easy. However, as society gets larger it becomes harder that a great number of individuals can commit to complying a norm. Likewise, in a large society individuals acquire a certain form of anonymity that makes it more difficult to monitor their behavior. When this occurs, frictions such as *the lack of commitment* and *perfect monitoring* hinder pure credit trades. When the three frictions plague the good and service markets, trade cannot be conducted through barter or pure credit trades. Individuals can then use monetary trades. As Kocherlakota (1998) emphasized, under a pure credit economy each agent can be thought of as keeping an imaginary balance sheet. When one agent produces something for someone else, his balance increases, as well as his access to future transfers. In contrast, when an individual consumes something produced by someone else, it reduces her balance and limits her reception of future transfers. However, when a society lacks commitment and has no monitoring, it is not possible to know whether an individual is running a deficit or surplus. When an agent is asked to produce, he does not know if the counterpart produced for someone else in the past. The issue can be solved if the counterpart shows the money received from a past trade to prove that she did produce. In this regard, monetary trades help mitigate information limitations by providing a certain record of trading histories when a perfect record-keeping technology is not available.

While it is true that in a large society commitment and monitoring are harder, they are not impossible. Individuals can both commit and be monitored to a certain extent. For instance, people could be disciplined to repay their obligations by reputational considerations. If they defaulted, it would dissolve long-term valuable relationships of consumption and production. Moreover, financial institutions like banks keep an imperfect record of their clients and use it to punish defaulters. Thus, under limited commitment and imperfect monitoring some credit arrangements other than pure credit trades can take place. In these imperfect credit arrangements, as commitment and monitoring are imperfect, default is a possibility and at least a fraction of borrowers

reneges.

To summarize, where there is no double coincidence, barter is not an option; where commitment is limited and monitoring is imperfect, a pure credit economy is not available. Under such circumstances, assets can render liquidity services through two transaction mechanisms: monetary trades and (non-pure) credit trades. In modern economies where commitment is limited and monitoring is imperfect, both transaction mechanisms coexist and interweave in complex manners. However, there are differences between them. On the one hand, monetary trades and credit trades differ in the settlement period. Trades conducted through monetary trades have an immediate finality, while those conducted through credit trades have a gap between the transaction date and the settlement date. On the other hand, there is a tension between the frictions that give rise to monetary trades and credit trades. If agents cannot be monitored and anonymity is total, monetary trades play a role but credit trades are ruled out. If anonymity disappears and agents are perfectly monitored, monetary trades play no role but credit trades are feasible. In conclusion, assets belonging to the kind 'liquid assets' are grouped together based on the functional property of liquidity. However, there are two genuinely different ways through which such assets can facilitate transactions. Trades can be conducted through monetary trades or credit trades. We have thus a case where the kind 'liquid assets' has genuine multiple realizers.[38]

Notice that in the case of 'money' studied above MR failed because gold and silver were not interestingly different ways to perform the function of means of payment. However, it does not mean that 'money' cannot be multiply realized. We could, for instance, distinguish between means of payment used via monetary trades (e.g. dollar bills) and those used via credit trades (e.g. credit cards). We could also restrict the group further as monetary economists sometimes do, and claim that 'money' only includes assets that work as a means of payment via monetary trades. In such a case, we could distinguish between assets that help us to trade via fiat money transactions (e.g. dollar bills) and those via commodity money transactions (e.g. gold coins). Another possibility is to say that there is a group 'credit' containing assets that provide liquidity services only via credit trades, and that two interestingly different ways in which assets perform such a function are secured credit (e.g. Treasury bonds) and unsecured credit (e.g. credit cards).[39] All of these are groups that reflect different liquidity-based asset classifications. Whether we should consider them as genuinely multiply realized kinds is something that should be addressed case-by-case. In this chapter, I only offer an

[38]More recently, Shapiro (2008, p. 522) added a new condition: 'The differences in realizers that are relevant to MR should not be differences that cause only differences in the realized properties.' There are causally relevant differences between monetary trades and credit trades that go beyond just making the degree of liquidity different. Credit trades, for example, involve the payment of interest and have a specific regulation to prevent and deal with default.

[39]Note that if we take 'money' to only include assets that work as a means of payment via monetary trades and 'credit' to include only assets that work as a collateral in credit trades, then 'money' and 'credit' are the lower-level kinds that realize through two genuinely different ways the higher-level kind called 'liquid assets'.

argument for the kind 'liquid assets.'

3.3.2 Part II: Shapiro's dilemma and kind-making empirical commonalities

I have already demonstrated that there are multiple realizers of 'liquid assets.' As we saw above, on conceptual grounds the presence of multiple realizers does not necessarily entail that we have to split the realized kind. However, the first horn of Shapiro's dilemma may still be used against the multiple realization of 'liquid assets'. It can be argued that there might be no empirical commonality among assets that provide liquidity services via monetary and credit trades that justify grouping them into a higher-level kind. The aim now is then to determine whether there are kind-making empirical commonalities between, for example, dollar bills that are used as a means of payment in monetary trades and Treasury bonds that are used as collateral in credit trades.

Shapiro (2000, p. 649) admits that the different realizers of a functional kind may have in common precisely the function that defines such a kind.[40] However, in his view such a commonality is an analytic rather than an empirical generalization. For instance, camera eyes and compound eyes have in common the function to see, which, according to Shapiro (2000), is an analytic truth as it only claims that eyes are for seeing. Weiskopf (2011) questioned the soundness of Shapiro's analytic-empirical distinction by pointing out that although it might be analytic that eyes are for seeing, it is an empirical generalization that seeing involves taking in ambient light. Furthermore, the decision of what counts as an eye is not always straightforward and involves 'comparative empirical work that requires drawing lines to separate interestingly different sorts of structures—in this case, simple light sensors versus proper eyes.'

The decision about whether a given asset counts or not as a 'liquid asset' is also not straightforward. As it will be shown in Chapter 4, there is no absolute standard of liquidity from which one could draw a clear-cut distinction between groups of assets. The difference among such groups of assets remains a difference in degree and not in kind. Accordingly, when economists use statistics of monetary aggregates, they rely on other empirical criteria that allow them to draw the dividing line in a point that is interesting for scientific and policy purposes. Thus, even if one could successfully argue that liquidity is an analytic generalization—*liquid assets are for facilitating transactions*—such a generalization would still require additional empirical considerations to determine, for instance, whether a particular asset should be regarded as a member of 'liquid assets.'

Liquid assets that circulate via money trades or credit trades also have other empirical commonalities. First, they are socially beneficial. They allow us to expand our capacity of consumption and production. Without them, exchange would be severely restricted to barter or the violent appropriation of resources. Second, liquid assets are also valued by their liquidity services. It is usually accepted that the price of assets is

[40] This, of course, is not surprising once one has in mind Shoemaker's account in which, as already seen, the forward-looking casual features of the realized kind are a subset of those of its realizers.

determined by the fundamentals. However, in the case of liquid assets, its price can be determined by both the fundamental value and the liquidity value. For instance, as I have pointed out in previous chapters, a dollar bill has zero fundamental value, however, it is positively valued in trade because of the liquidity services it provides. Likewise, Treasury bonds provide liquidity services by serving as collateral in secured credit. Thus, they have an additional demand due to their liquidity that pushes their prices up and drive down their returns with respect to assets of similar safety and maturity but arguably less liquid.[41]

The above empirical commonalities question Shapiro's (2000) claim that lower-level kinds, with genuinely distinct causal properties, cannot constitute a higher-level kind. Even though assets can render liquidity services through two actually different mechanisms, it does not prevent them from having kind-making empirical commonalities.

3.3.3 The explanatory value of 'liquid assets'

'Liquid assets' are a multiply realized kind. But how can we know that it is a natural rather than a spurious kind? Unlike spurious kinds, natural kinds perform well in supporting scientific practices like inductive inference and explanation. Thus, a criterion to distinguish natural kinds from spurious kinds is that the former figures in scientific explanations. New Functionalism does not require that for a kind to be called natural kind it has to feature in scientific laws. Instead, New Functionalism claims that a functional kind earns its credential of natural kind by playing a role in explanatory models. This shift from a nomological to a model-based criterion to decide about the naturalness of kinds is especially relevant for economics, a discipline where the deductive-nomological explanation is discredited and modelling became the dominant way of doing research.[42]

Therefore, for New Functionalism, rather than figuring in law-like empirical generalizations, it is a kind's explanatory value in economic models what counts for its naturalness. I mentioned above that membership in the kind 'liquid assets' can explain cases where the price of an asset departs from its fundamentals. In the case of both a dollar bill and a Treasury bond, the price of the asset is influenced by liquidity considerations. That is, the kind 'liquid assets' has explanatory value as it helps explain behaviors of asset prices that cannot be rationalized by simply appealing to the fundamentals. The kind 'liquid assets' plays an epistemic role in explanatory models, thus satisfying a condition to be regarded as a natural kind.

[41] For empirical evidence of the liquidity premium of Treasury bonds, see Krishnamurthy and Vissing-Jorgensen (2012), Nagel (2016), and Lee (2019). For models that incorporate liquidity considerations for asset prices, see Geromichalos, Licari, and Suárez-Lledó (2007), Lagos (2010), Nosal and Rocheteau (2013), Andolfatto and Martin (2013), Rocheteau and Wright (2013), Hu and Rocheteau (2015), Jung and Pyun (2016), and Lee and Jung (2019).

[42] For a discussion of the deductive-nomological explanation in economics, see Hausman (1992) and Lallement (2007). There is a sizable literature about economic models, see, for example, Mäki (1992; 2013), Morgan and Morrison (1999), Sugden (2000), Cartwright (2009), Hindriks (2013), Grüne-Yanoff (2013).

However, the model-based criterion to the naturalness of kinds faces a challenge in economics. Economic models are idealizations that may contain a great number of false assumptions, which can violate the standard requirement that for having an actual explanation the *explanans* has to be true. The presence of false assumptions in economic models can then lead to the conclusion that economic models are not explanatory. Alexandrova and Northcott (2013, p. 262), for instance, opine that economic models 'do not qualify as causal explanations because they are false and therefore they do not identify any actual causes.' If economic models cannot explain, then the explanatory value of a kind cannot be determined. That is, in economics we would lack the resources to distinguish natural kinds from spurious kinds.

The claim that economic models are not explanatory, in that the falsity of assumptions implies automatically the falsity of explanation, can be questioned. Marchionni (2017) has argued that framing the debate about models' explanatory power in such a way risks conflating two separate issues. First, the *conceptual* discussion about the conditions a model has to satisfy to count as explanatory. Second, the *epistemological* discussion about whether a model satisfies or not such conditions. With respect to the conceptual discussion, Marchionni (2017, p. 608) takes explanation to be 'a matter of citing the factors that make a difference to their effects.' Thus, the presence of false assumptions does not necessarily preclude a model from being explanatory as many false assumptions are made to exclude factors that are explanatory irrelevant. Marchionni (2017) furthermore notes that explanation has distinct attributes. An explanation can be *partial* or *complete* depending on whether it includes some or all of the causes that make a difference. An explanation can also be *actual* or *potential* depending on whether the *explanans* meets or not the truth requirement. An explanation can be *specific* or *general* depending on whether the target is an instance of a generic phenomenon or the generic phenomenon itself. Building on this more nuanced view of explanation, Marchionni (2017, p. 611) sets out a different requirement for a model to be explanatory: 'a model is explanatory when it provides explanatorily relevant information in virtue of successfully representing some of the [actual] causes that make a difference to the explanandum phenomenon.'

Regarding the epistemological discussion, Marchionni (2017, p. 606) points out that in economics we hardly know if the requirement for model to be explanatory is satisfied or not. Some peculiarities of model-based explanation contribute to such a lack of certainty. One is that it is not always easy to determine whether a false assumption is explanatory relevant or not; another is that it may be hard to determine whether the relation between a theoretical model and an empirical model is strong enough to conclude that the theoretical model is actually supported by data. Therefore, Marchionni (2017, p. 627) claims that rather than being discretely organized into potential or actual, model-based explanations 'lie on a continuum between being potential and probably, or very probably actual.' Marchionni (2017) also describes a combination of strategies that can increase the confidence in a given model-based explanation. A theoretical strategy is the robustness analysis that allow one to check if a certain assumption is crucial for the result. If after changing a false assumption by

another the same results holds, then the modeler's can be more confident about model's outcome. Empirical strategies include testing the theoretical outcomes against data and checking the empirical validity of crucial assumptions and proposed mechanisms. Thus, for instance, after a combination of different strategies, one can conclude that a model-based explanation has sufficient empirical evidence and theoretical robustness to move from potential to probably actual (or from possibly actual to potential in a case where our confidence in the model deteriorates).

That the explanatory power of a model-based explanation lies on a continuum is consistent with the idea that it is a 'graded matter' whether a functional kind is a natural kind as there is no general answer to the question of how significant the role played by a kind in a range of models must be to count as a natural kind (Weiskopf, 2011, p. 252). I should add that there is also no general answer to the question about how much evidence and robustness analysis is needed for a kind featuring in a model to be deemed as actually explanatory. This is also consistent with the idea that natural kinds proposed by science are not immutable categories. Science can revise the existence and extension of natural kinds according to both the new evidence and the new theoretical developments. We can reinforce or diminish our belief in a given natural kind based on the updated information about the ability of the category to play a role in explanatory models.

Liquidity-based asset classification can give us an example of how economists may revise their categories. 'Money' is a category that has been largely associated to the function of means of payment. However, now monetary economists are more convinced that such a function is a way of rendering liquidity services but certainly not the only one. I have mentioned that a Treasury bond can provide liquidity services by serving as collateral in secured credit. In practice, a Treasury bond can also be easily sold in a secondary market in exchange for a more liquid asset, say, dollar bills or even directly used as a means of payment.[43] It is still too early to know if as a result of the transformations of trading practices and the developments of monetary economics the common use of the category 'money' by economists, policy-makers, and lay people will evolve to include assets other than fiat currency like Treasury bonds, or if rather 'money' will denote a subgroup of very liquid means of payments, such as fiat currency, within the larger category of 'liquid assets' (or whatever name this larger category could finally take).[44]

[43]Monetary economists are recently trying to integrate all these types of liquidity services in a unified theoretical framework of liquidity. See, for example, Geromichalos, Jung, Lee, and Dillon (2019).

[44]Kiyotaki and Moore (2019) seem inclined to prefer the first option: '[T]here are many financial assets that are hardly any less liquid than money—for example, government bonds. Thus, in our stylized model, "money" should be interpreted very broadly to include all financial assets that are essentially as liquid as money.'

3.4 'Liquid assets' and mind-dependence

Natural kinds capture *real* divisions of the world. Natural kinds can thus be regarded as *real* kinds that help us to identify what *exists* in the world. This perspective, however, raises a challenge for functional kinds in the social world. According to standard definitions of realism, if an object exists, the fact that the object exists does not depend on anyone's beliefs (Miller, 2019). However, the unifying functions of functional kinds in the social world are not only brought about by the interior properties of the kind's members. Instead, such functions imply a set of social practices (i.e., exterior interactions) in which the human mind inevitably intervenes. Therefore, functional kinds posited by the social sciences are typically dependent on what we think of them. In that sense, functional kinds in the social world could fail to be real kinds. This is the position upheld by Ellis (2002/2014, p. 162) regarding kinds in economics,

> [...] market economies do not constitute a natural kind. There are markets, and market transactions, but these are social institutions or processes, not things or processes of kinds that exist in nature independently of human knowledge, language or customs.

Kinds whose existence depends on human minds are viewed by realist philosophers with suspicion for at least two reasons. On the one hand, mind-dependent kinds could be merely a product of our fertile imagination and thus are not different from fictional kinds that reflect no property of reality. On the other hand, the mind could have a non-causal contribution to the existence of mind-dependent kinds, making them knowable *a priori* by conceptual analysis rather than discoverable *a posteriori* by empirical research. Since liquidity is a human creation, the categories that it grounds become ontologically suspicious: such categories might be non-real kinds. In the previous section, I argued that the kind 'liquid assets' meets the criteria to be deemed as a natural kind; however, I left implicit that mind-dependence does not pose any threat to realism about 'liquid assets.' In what follows, I will make explicit the motives.

3.4.1 'Liquid assets' and fictional kinds

There is a view, based on an interpretation of Searle's theory, that kinds like 'money' are on par with fictional kinds. I do not intend to wade into exegetical discussions about what Searle really meant. Instead, my aim is to expose such a view and then discuss why 'liquid assets' is not a fictional kind.

Searle's (1995) theory claimed that by collective acceptance of a constitutive rule we impose a status function Y on a physical object X. Therefore, institutional facts had ultimately to bottom out in 'phenomena whose existence is not a matter of human agreement' (Searle, 1995, p. 95). However, after a criticism by Smith (2008), who pointed out that there are cases like electronic money, corporations, and blindfold chess that have no physical realization, Searle (2010) admitted the existence of cases so-called

freestanding Y terms. To avoid the conclusion that electronic money, corporations, and blindfold chess are just floating on thin air, Searle (2010, p. 109) argued that freestanding Y terms had to bottom out in actual human beings who also would be the holders of *deontic powers* linguistically created such as rights, duties, obligations, requirements, and authorizations.

According to Searle's (2010, p. 93, 109) theory, we can then create institutions by representing and recognizing them as existing, without them being necessarily realized on physical objects, and by assigning deontic powers to actual human beings. However, some philosophers noted that if these are the features of institutions, then fiction could qualify as an institution. According to Martinich (2008, p. 211), although statements like 'Sherlock Holmes was a detective' or 'Sherlock Holmes had Dr. Watson as a friend' are not scientific truths, they are truths about fiction because there are facts that make them true. What sort of facts make the statements of fiction true? The answer is that fictions are themselves institutional facts,

> The basic fact about institutional facts is that they exist because people [...] accept them as factual. It is a fact that the paper currently on my desk is 100 yuan because I, following the beliefs of one billion Chinese, accept that it is 100 yuan [...]. In the same way, statements [...] [about Sherlock Holmes] are true because readers of Conan Doyle's stories [...] accept them as true, and accept them as true because of the narration of those stories (Martinich, 2008, p. 212).

Searle (2008, p. 223) refused the above argument by saying that the 'decisive objection' was that 'no deontic powers attach to fiction.'[45] For Searle (2008, 2010) thus the presence of deontic powers drives a wedge between institution and fiction. However, Martinich (2017, p. 108) replied that there are deontic powers involved in fiction, as the *storyteller* has the 'right to complete his story and the right not to be interrupted' and is also entitled to 'copyright' and faces obligations regarding 'libeling' people.

Whether Searle's theory has or not the resources to block the identification of institution with fiction, it is a discussion I cannot afford to address here. Be that as it may, the point is that there are central elements of Searle's theory that has been regarded as supportive of the view that mind-dependent kinds like 'money' are on par with fictions. This view has also been stimulated by certain ambiguity that appears in some Searle's writings such as when he described financial instruments as so,

> It is, for example, a mistake to treat money and other such instruments as if they were natural phenomena like phenomena studied in physics, chemistry, and biology. The recent economic crisis makes it clear that they are products of massive fantasy (Searle, 2010, p. 121).

[45] Searle (2010, p. 121) made a similar remark when pondering over the role of imagination in the creation of institutions. While children can play in fantasy to perform certain roles, in maturity adults can create an institution that actually exists as it 'regulates and empowers our social life.'

Why 'products of massive fantasy'? One interpretation is to take Searle at face value and conclude simply that for him financial instruments like *dollar bills, mortgages, bonds* are on par with fairies, smurfs, and elves. This conclusion would be in the same line of those who think that Searle's theory authorizes to regard fiction as an institution. In a similar vein, Smith (2012, p. 191) sees in the above quote Searle's adherence to a 'fictionalist approach' in which institutions like money do not exist: People just trick each other pretending to make payments in trade. For Smith (2012, p. 191), Searle endorsed this approach to save the physicalism of his theory 'but only through the back door of false beliefs on the part of the persons involved.'

A more charitable interpretation is that Searle remains convinced that deontic powers are a criterion capable of distinguishing institution from fiction. Rather, he called financial instruments 'products of massive fantasy' because he believes that the financial crisis made asset owners' deontic powers disappear. However, if this so, Searle is to be blamed for getting the crisis wrong. With the crisis the value of specific assets crashed (i.e., instances of the kind). But despite price collapse, in the aftermath of the crisis dollars, bonds, mortgages, and equity continued to be traded and to provide liquidity services. Whatever harm the crisis caused, it did not extinguish, when considered as a kind, 'liquid assets.' [46]

I have identified above a view for which there is no distinction between institution and fiction. This view might justify the fears of those realists who think that mind-dependence is a mark of non-real kinds and that thus we must embrace a mind-independence criterion to realism about kinds. Although motivated by a legitimate concern, such a position is, however, problematic. It relies on the wrong assumption that a mind-independence criterion can separate natural (real) kinds from fictional (non-real) kinds. There are artificial and synthetic kinds in the natural world that, even though mind-dependent, can be regarded as natural kinds. Khalidi (2016, p. 226) has pointed out that, for example, synthetic chemicals as *Methylphenidate*, genetically engineered plants as *Triticale*, or artificially selected animals as *Dog* are remarkable counter-examples to the mind-independence criterion. All these kinds depend to some extent on human beings, and their minds and could have never been instantiated without human influence. Thus, mind-independence cannot be taken as a suitable criterion for deciding regarding realism about kinds.

What then is the criterion? Within the tradition of natural kinds, there is an answer that says that such a criterion is the 'causal criterion of reality' (Khalidi, 2016, p. 226). As I showed above, in practice we accept as natural kinds those groupings that figure in our best scientific theories. A successful scientific explanation includes natural kinds because they are useful to pursue our epistemic interest to undercover the causal structures of the world. They are useful in that purpose because natural kinds refer to properties that have causal powers and inductive potential. Properties that define a natural kind thus participate in complex causal patterns and allow scientists to make important generalizations (Khalidi, 2013). Beyond the specific causal pattern at work,

[46] To the best of my knowledge, the first in perceiving this problem was Smith (2012, p. 191) who rightly pointed out that Searle confused 'loss of value' with 'loss of existence.'

the central point is that natural kinds are projectable; they support inductive inference and have explanatory value.

Therefore, the relevant difference between 'liquid assets' and fictional kinds is that the latter are not projectable. While fictional kinds have no inductive potential in virtue of which they participate in scientific inferences and explanations, the kind 'liquid assets' plays an important epistemic role in economic models. Thus, rather than based on a mind-independence criterion, the distinction between natural kinds and fictional kinds is to be made on the basis of a causal criterion of reality. In this sense, mind-dependence does not threaten the realism about 'liquid assets.' [47]

3.4.2 Constitutive and causal mind-dependence

Another version of mind-dependence that can be problematic for realism about 'liquid assets' is that in which the mind is somehow *constitutive* of kinds.[48] Khalidi (2016, p. 230) has explained that constitutive dependence refers to 'a conceptual or analytic dependence, according to which minds are part of the definition of certain phenomena but not others.' Therefore, that constitution of a given kind is linked to human mind means that mind enters into kind's definition.

Thomasson (2003) presented a version of constitutive dependence in which institutional facts depend on mental states, i.e., propositional attitudes such as beliefs or expectations, for their existence. For her, there are facts like recessions or racism whose existence does not depend on anyone theorizing or conceptualizing about them. Indeed, a recession could occur without anyone being aware of or even having the right concept. In contrast, there are institutional kinds like 'money' that depends for its existence on being theorized or conceptualized as such. In these cases, the relevant mental states are directed toward the kind itself rather than toward its members. Thus, for a thing to be 'money,' it must be believed to be 'money' instead of being dollar, euro, pound, etc.

Drawing on the Searlean account of institutions, Thomasson (2003, p. 585-591) claims that an institutional kind only exists if people believe in a constitutive rule that specifies the conditions C for X to count as K, where X is a physical object and K denotes an institutional kind. Once the rule is collectively accepted, anything X that satisfies C belongs to K. But since kind membership depends on our beliefs, we cannot be wrong about it. As we accept C as sufficient for there being K, it cannot be the case that we fail to know whether a certain X belongs or not to K. Kind membership is knowable *a priori*, and thus there is no risk of misclassifying X. Rather than being an empirical matter, mind-dependent kinds require only conceptual analysis and, consequently, are not open to scientific investigation.

[47] As the criterion of causal reality does not necessarily rival with mind-dependence, it is possible that a fiction can become a real kind. As Khalidi (2016, p. 243) remarked, if in line with the current practice of most biologists, we take race not to be a biological kind, then we have a case in which a fiction became a real kind. Once race does not motivate any differentiated treatment, all its negative effects will be gone.

[48] For the distinction between causal and constitutive mind-dependence, see Kukla (2000).

This version of mind-dependence delivers important implications. If it holds true, both the realism about the kind 'liquid assets' and the ability of economics to inform about it would be compromised. Nonetheless, as we will see, Thomasson's (2003) argument does not stand and therefore its serious implications can be safely dismissed. A feature of the Searlean account of institutions is the inclusion of the dollar's issuance conditions within the constitutive rule that brings 'money' into existence (Searle, 1995). In line with such a practice one could then say that whenever we collectively accept the constitutive rule *a paper bill counts as 'money' if it is issued by a central bank*, we cannot be wrong about the moneyness of a paper bill that has been effectively issued by a central bank.

The constitutive dependence argument so expressed has the advantage that it gives us a test case. So, how sound is it? As Guala (2016b) has argued, the above formulation about the kind 'money' runs against the evidence. In a hyperinflation the value of fiat currency declines so severely that often the bills of lower denomination are no longer accepted in trade, despite being issued by a central bank. In Venezuela's ongoing hyperinflation low-denomination bills stopped being means of payment and even became input for a handicraft production called 'Money Art' (CGTN, 2018; Hernández, 2018). Although people may continue calling them 'money,' these *bolivares* do not provide liquidity services anymore. Against what is defended by some mind-dependence theorists, what these examples are telling us is that the kind termed 'money' is not constituted by 'arbitrary conventions concerning the issuing of paper bills' (Guala, 2016b, p. 169). Accordingly, we are not free of error regarding kind membership; and rather than conceptual analysis, it is empirical research what has to be conducted to determine the degree of liquidity of a given currency.

The conclusion is reinforced when we broaden the perspective toward other assets that also provides liquidity services. A bond that is perceived as a safe asset will be largely accepted as collateral. But if the issuing government becomes insolvent, no matter that the bonds have been issued by the treasury, they will not render liquidity services anymore. The kind 'liquid assets' thus is not constituted by the acceptance of a constitutive rule that expresses assets' issuance conventions.[49]

The above version of mind-dependence does not apply to 'liquid assets.' It does not mean, however, that such a kind is mind-independent. The liquidity of an asset depends on asset's acceptability in trade (the greater the acceptability, the higher the degree of liquidity). But what people are ready to accept in trade today depends to some extent on what they think others will readily accept in trade in the future. Beliefs have a clear influence on liquidity and thus on the members of the kind 'liquid assets.' However, there is a crucial difference between the mind-dependence studied by philosophers like Thomasson (2003) and that studied by finance professionals and

[49]Searle and Thomasson have never theorized about 'money' in terms of liquidity. As well as these social ontology theorists have been blind about liquidity, the same can happen to a borrower that obtains a line of credit collateralized by a mortgage. She might not know that her mortgage is providing liquidity services, thereby proving the notion that our mental states could be a constituent of liquidity to be wrong. Mäki (2009) and Guala (2010) also offer a critical discussion about the relationship between 'money' and constitutive mind-dependence.

monetary economists. Finance professionals and monetary economists are worried about the *causal* influence of human beliefs on the dynamics of asset prices.

A typical concern among distinct accounts of asset pricing is that market participants' beliefs can drive asset prices above the level justified by fundamentals, thus creating a financial bubble. The finance guru George Soros (2013, p. 311) mentioned that in the financial markets there are feedback loops between market participants' expectations and asset prices. These feedback loops can be regarded as an expression of a reflexivity relationship between the mind and the world, sometimes in the 'direction of causation' from the mind to the world and other times from the world to the mind. Similarly, monetary economists are interested in researching if bubble-like asset prices can be caused by liquidity considerations. As the liquidity value that rises asset prices above fundamentals depends at least partly on beliefs, asset-price trajectories that resemble the growing and bursting of bubbles can be generated as a self-fulfilling prophecy (Rocheteau and Wright, 2013).

Therefore, the kind 'liquid assets' is mind-dependent but depends on mental states in a *causal* fashion. For some philosophers, however, this causal dependence is just an example of 'mundane' mind-dependence (Jenkins, 2005, p. 199). The reason is that both mental activity and social practices 'make no non-causal contribution to the causal structures of the phenomena scientists study' (Boyd, 1992, p. 173). Scientific investigation is largely concerned about the causal structures of the world, and there is nothing in the causal influence of mind that makes the mind-dependent kinds, as a matter of principle, inaccessible to scientific research (Mäki, 2011; Haug, 2011; Guala, 2016b). In practice, this dependence can surely raise more difficulties for economists, additional to those they face regarding information availability, technological resources, or the tractability constraints. But while operating within these limitations, economists are reasonably able to characterize the causal effects of mental states on liquidity. Causal dependence thus does not necessarily prevent kinds like 'liquid assets' from being scientifically precious. This version of mind-dependence is no menace either for realism about the kind 'liquid assets.'

Chapter 4

What Do We Call Money? An Appraisal of the Money-or-nonmoney View

4.1 Introduction

During a talk at Goethe University, Agustín Carstens, General Manager of the Bank for International Settlements, asserted that 'the meteoric rise of bitcoin and other cryptocurrencies has led us to revisit some fundamental questions that touch on the origin and raison d'être for central banks.' One of those questions was precisely 'What is money?' (Carstens, 2018, p. 1). Although we do not usually ask ourselves what money is, we are all competent in the practice of using banknotes, coins, checks, etc. Despite the ease with which we master the practice of using it, explaining money has proved to be an arduous task. While economists, historians, anthropologists, sociologists, and philosophers have made strides in improving our understanding of money, we report that to date, there is no consensus among scholars on the definition of money.

Therefore, what should we call money? Beyond national currencies such as dollars, euros, or pounds that we all indisputably agree on calling money, it is more elusive and controversial to determine whether other things used in transactions should be called money. Are bitcoin, litecoin, dogecoin, or ethereum, to name a just few, money? The question asked so often entails the presupposition that there is a body of knowledge that enables us to produce a yes or no answer. Accordingly, it is thought that it is somehow possible to categorically distinguish money from nonmoney. Often, the 'is this money?' question, along with its underlying presupposition, is prompted in economics from the outside, as illustrated by the case of cryptocurrencies. However, economists are not just receptors of an external demand for money-or-nonmoney classifications. Accurately dividing certain objects into money and nonmoney has historically been an objective within the discipline. We do not provide a careful historical account of the origins and current echoes of this classificatory ambition in economics. However, we detail a way of reading Menger (1892) that exemplifies an early effort to clearly differentiate between those objects that are money and those that are not. We remark that for Clower (1967), a clear distinction between money and nonmoney was the natural starting point of monetary theory. Building on Friedman and Schwartz (1970), we also show that a number of economists who participated in the debate on the construction of monetary statistics sought to draw a sharp dividing line between money and nonmoney. Admittedly, they disagreed on the correct approach to drawing the dividing line.

To set our target in this chapter clearly, a label should be introduced. We call the perspective that there is a set of defining characteristics of money that make money categorically different from other things *the money-or-nonmoney view*. The difference between money and nonmoney is a matter of kind and not of degree. On this view, therefore, it is possible to draw a precise dividing line between money and nonmoney. Recently, Smit et al. (2016) faced the question of whether bitcoin is or is not money. Beyond the merits of their answer, we believe that a great contribution of their work is that in placing their strategy on philosophical grounds, they allow us to discuss what would be needed for *the money-or-nonmoney view* to succeed. We draw on their work to illustrate the connection between *the money-or-nonmoney view* and the venerable

philosophical discussion on the existence of natural kind essences. In particular, we show that for *the money-or-nonmoney view* to achieve its purpose, it should identify what is philosophically called the kind essence of money.

In the version of essentialism studied in this chapter, a natural kind essence is understood as the set of characteristics that are referred to as the intrinsic properties that are necessary and sufficient for membership in a particular kind. The roots of traditional essentialism can be traced back to Aristotle, who was one of the first authors to express the idea that we can make classifications that reflect the nature of things. Such classifications are successful insofar as it is possible to identify essences that indisputably determine that an object or phenomenon belongs to one natural kind and not to another. Since then, different thinkers have taken up this idea, and some of them have begun to assert that the essences shared by all objects or facts belonging to a particular natural kind can be used in inductive reasoning to formulate universal laws. Some philosophers believe that Menger adopted an essentialist position as a basis for the construction of his work, notably his influential ideas on money.

We are interested in discussing the potential applicability of traditional essentialism to money. If applicable, economists could categorically distinguish, like chemists can with chemical elements, between money and nonmoney, and the aim of *the money-or-nonmoney view* would be achievable. In this chapter, we challenge *the money-or-nonmoney view* and the traditional essentialism that this view endorses. For *the money-or-nonmoney view* to succeed, it is necessary that objects termed money are categorically distinct from those termed nonmoney. This is possible if, following traditional essentialism, a gradual transition between money and nonmoney never occurs. We therefore argue against *the money-or-nonmoney view* by criticizing the traditional essentialism underlying this view. Specifically, we point out that based on what is currently known by monetary economists, there is no set of intrinsic properties that form the natural kind essence of money. Membership in the kind 'money' is largely defined by exterior relations of objects and individuals with the determinants of fundamentals and beliefs about acceptability. Furthermore, we remark that it has not been possible to identify a set of necessary and sufficient characteristics, whether interior or exterior, for membership in the kind 'money.' Consequently, there is nothing in the nature of money that can be interpreted as a natural kind essence that one could use to unambiguously separate money from nonmoney.

In contrast, we outline what we call *the liquidity degree view*. On this view, because objects are valued according to the degree to which they are accepted in trade, there is no absolute standard but rather a scale that reflects various degrees of liquidity. Not surprisingly, *the liquidity degree view* questions the purpose of drawing a sharp dividing line between money and nonmoney. A practical implication of *the liquidity degree view* is that the question of whether bitcoin is or is not money should be abandoned. Bitcoin can be described as a means of payment with a poor degree of acceptability.

Before we begin, two clarifications must be made. First, we do not produce an argument against versions of essentialism other than traditional essentialism. If what modern monetary economists have learned about money can support other

essentialism variants, especially those that do not require a clear-cut distinction between different natural kinds, it is certainly a matter that will not be sufficiently explored here. Second, the dualistic framework used in this chapter is a starting point for contrasting two general opposing views on what should be called money. However, we do not discard that a more fine-grained distinction could be established.

4.2 Natural kinds and essentialism

For those who lack training in philosophical matters, natural kinds and essentialism are terms that can sound odd. Because the discussion of *the money-or-nonmoney view* involves the use of such notions, in this section, we provide a succinct presentation of these concepts. This section also includes a brief description of how these ideas could have permeated Menger's paradigmatic work on money.

Scientific practices cover a wide range of activities. These practices include proposing ways of classification and methods for researching the results of such classifications. Philosophers of science have noted a fundamental distinction between at least two sorts of classification. There are classifications that are intended to capture real, existing divisions in the world, while other classifications are arbitrarily set for reasons of convenience, such as those involved in organizing or simplifying the complexity of a certain domain.

The idea of classifications that are successful in providing us with guidance on the world's own divisions is what some have called natural kinds. The discussion around this notion has a long history. According to Wilkins (2009), Locke was the first to introduce the term kind in English to replace *genos* and *genus*, while according to Hacking (1991), the term natural kind was coined by the logician John Venn in 1866. Ellis (2002/2014) traces the tradition of natural kinds back to Aristotle, who believed that the world ultimately consists of four elements (earth, air, fire and water) and that all that exists can be separated into things that exist by nature, things that exist by art, and things that exist by chance. Things that are termed natural kinds are commonly the products of nature rather than products of art or chance.

An important figure in the modern tradition of natural kinds is J.S. Mill (Hacking, 1991). Hawley and Bird (2011) show that for Mill, horses formed a natural kind, but white things such as leukocytes, chalks, white vans, clouds, comets, and white dwarf stars did not. These things are too dissimilar to correspond to a natural kind group. The existence of natural kinds is regarded supporting inductive reasoning. The knowledge of a kind's current members may justify inferences about new or hypothetical objects that arguably have the same kind of membership (Hacking, 1991; Brigandt, 2011).

According to Brigandt (2011), an account of natural kinds must explain how natural kinds differ from other kinds. One possibility is seeing natural kinds as characterized by an essence—some intrinsic, structural property shared by every member of the kind and causing the distinctive properties associated with it. For a long time, essentialism was regarded as an old-fashioned Aristotelian philosophy. Nonetheless, as Ellis (2002/2014, p. 7-12) comments, this view changed with the works of Kripke

and Putnam, who revived essentialism and made it 'respectable' again. Under their influence, some came to believe that scientific investigation is the only way to discover the essences of natural kinds (Lowe, 2007). In short, when deciding whether an object belongs to a natural kind, it must be determined whether the object possesses a kind essence. That is, the set of intrinsic properties that are individually necessary and jointly sufficient for kind membership. Thus, the transition between distinct natural kinds cannot be gradual.[50]

4.2.1 Aristotle, essentialism, and Menger on money

The philosopher Barry Smith (1990, p. 263, 266, 270, 277) asserts that there are good reasons for adopting an Aristotelian reading of Menger's work. He believes that the doctrine of Austrian Aristotelianism is characterized by embracing at least seven theses, including the indication that there are strictly universal 'essences' or 'natures' in the world that are governed by strictly universal laws. These are strictly universal because they do not historically change across time, space, and cultures. For Menger, then, propositions that express universal connections among essences are 'exact laws.' The Mengerian perspective also considers that there are essences in the social world and that scientific social knowledge of them is possible. In particular, economists study the general essences and connections of economic phenomena, including money.

Sharing a similar perspective, Mäki (1990, p. 289) proposes an interpretation of Mengerian economics as 'exemplifying a version of essentialist realism.' Mäki also believes that the idea of essence is useful in interpreting the Mengerian theory of money. He reads Menger as distinguishing between the nominal essence and the real essence of money. The nominal essence corresponds to those characteristics that permit a particular piece of matter to be an instance of abstract—'universal'—money. The real essence of money, instead, must be characterized in terms of the invisible hand notion.[51]

We believe that an Aristotelian-essentialist reading of Menger's 1892 work, while not free of controversy, makes sense. In this work, Menger challenges the perspective of money as an institution created by law and convention. He also challenges (1892, pp. 241, 254) Aristotle, Xenophon, Pliny, John Law, Adam Smith and others who believed that the peculiar qualities of precious metals are the reason for their election as a medium of exchange. For Menger, the crucial question is how certain commodities have been 'promoted' among all other commodities and accepted as general media of exchange, and his answer points to something 'unhistorical,' namely, human self-interest. Menger (1892, p. 242-243) believes that primitive economic humans gradually

[50] Khalidi (2013, p. 515) opines that essentialists are not united on the exact features that distinguish a natural kind. Nevertheless, for essentialists, each natural kind seems to be characterized by all or some of five features: '(1) properties that are necessary and sufficient for membership in the kind, (2) micro-structural properties, (3) intrinsic properties, (4) modally necessary properties, and (5) properties that are discoverable by science.'

[51] By the time of the publication of this chapter we were not aware of an unpublished paper by Mäki (2009) which is also an earlier contribution to the discussion about the relationship between essentialism and monetary theory.

learned the economic advantages of exchange. At the beginning, there was barter, but it was limited by the high number of simultaneous coincidences that had to be satisfied for the exchange to take place. Those difficulties would have been insurmountable obstacles to the growth of production and trade 'had there not lain a remedy in the very nature of things,' namely, *'the different degrees of saleableness (Absatzfähigkeit) of commodities.'* Such a remedy is the general phenomenon that includes the existence of money and the special case of 'almost unlimited saleableness' (Menger, 1892, p. 242-243, italics in the original).

In Menger's theory (1892), a commodity is more or less saleable according to the probability of success of disposing of it for a low price. A smaller difference between the buying and selling prices of an article is associated with higher degrees of saleableness. With the expansion of commerce, each individual learns the gains to be made from bartering her less saleable goods for those that are highly saleable. Tradition and habit have converted the most saleable of those commodities into the generally accepted medium of exchange. The reason why precious metals are the medium of exchange in so many places and moments in history is their *saleableness*, which is much higher than that of other commodities (Menger, 1892). However, at the end, Menger ponders whether the differences in the degree of *saleableness* become absolute so that a distinction between money and nonmoney can be made:

> Thus, the effect produced by such goods as are relatively most saleable becoming money is an increasing differentiation between their degree of saleableness and that of all other goods. And this difference in saleableness ceases to be altogether gradual, and must be regarded in a certain aspect as something absolute. The practice of every-day life, as well as jurisprudence, which closely adheres for the most part to the notions prevalent in every-day life, distinguish two categories in the wherewithal of traffic—goods which have become money and goods which have not (Menger, 1892, p. 252).

Mengerian theory has left a lasting impact on monetary economics (Alvarez and Bignon, 2013). Notwithstanding the well-known influence of Mengerian ideas, we want to remark that there is a long-standing view of the way that money must be distinguished from nonmoney. The following section is devoted to analyzing that view.

4.3 An appraisal of the money-or-nonmoney view

Smit et al. (2016) aim to provide a criterion to determine whether bitcoin is or is not money. Although their motivation is practical, the starting point is philosophical. Unlike other philosophical approaches to money in which there is no serious reference to any insight produced by economists, their account is developed in proximity to monetary discussions in economics. We agree with this manner of theorizing whereby economics and philosophy join forces to deliver a comprehensive explanation of the nature of money. We introduce their strategy, which is well summarized in the following passage:

> A [...] compelling answer to whether bitcoins are money would be to identify some theoretically interesting, explanatory characteristic shared by those things we *uncontroversially* consider to be 'money' and to see if bitcoin has the characteristic in question. This, roughly, is the same basic strategy as is used to determine the extension of *natural kind terms*, i.e., to determine whether whales are fish, whether 'heavy water' is water, whether 'fool's gold' is gold, and so on [...] (Smit et al., 2016, p. 327, italics added).

A major contribution of Smit et al.'s (2016) work is that by explicitly rooting their strategy in the idea of natural kinds, they allow us to discuss what would be needed for *the money-or-nonmoney view* to succeed. On *the money-or-nonmoney view*, there is a set of defining characteristics of money that make money categorically different from other things used in transactions. Because the difference between money and nonmoney is a matter of kind and not of degree, on this view, it is possible to draw a sharp dividing line between money and nonmoney. We think that the classificatory ambition of *the money-or-nonmoney view* implies adherence to the traditional essentialism of natural kinds. Following traditional essentialism, *the money-or-nonmoney view* requires identifying the set of necessary and sufficient characteristics that are the intrinsic properties of things that unambiguously form the natural kind designated by the term money. Thus, the question of whether a thing is or is not money can be regarded as a question about the possession of a natural kind essence. If they possess some natural kind essence, those objects called money can be considered categorically distinct from those called nonmoney and a sharp dividing line can be drawn.

We do not provide a detailed historical background of this view in economics. However, we believe that if Menger (1892) is an early proponent of *the money-or-nonmoney view*, Clower (1967) is a legitimate successor. Clower argues that the process of exchange suggested by Patinkin's monetary theory was indeed descriptive of a barter economy. The traditional budget equation did not preclude trade between any combination of commodities, and consequently, any commodity could be directly used in trade. The solution, for him, requires a clear distinction between money and nonmoney commodities. In a pure monetary economy, the role of money is ascribed to any commodity that can be directly exchanged for *all* other commodities. Therefore,

> The exchange relation of an economy either does or does not assign a special role to certain commodities as money. The distinction between money and other commodities is thus a matter not of degree but of kind (Clower, 1967, p. 5).

Shortly after Clower, Friedman and Schwartz (1970) noted that one approach to constructing monetary statistics sought to form a group of assets called 'money' based on a theoretical principle. For economists such as Newlyn (1964), Gramley and Chase (1965), Pesek and Saving (1967), and Yeager (1968), assets that belong to the group 'money' must possess the same feature that, according to the theoretical principle, is distinctive of money. For example, some of these economists agree that the term money should be restricted to currency plus demand deposits, as these are the only assets

that have the feature of being a medium of exchange. Adherents of this approach have full membership in *the money-or-nonmoney view*. Commenting on this approach, Yeager (1968, p. 66-67) writes:

> Whether or not a thing serves as a general medium of exchange might even seem a mere matter of degree[.] [...] At some point, apparently, the shading or drift from the properties of close near-moneys toward those of money becomes a jump from a difference in degree to a difference in kind. [...] [T]his really may be the way things are with money.[52]

In the next subsection, we challenge *the money-or-nonmoney view*, arguing that the traditional essentialism of natural kinds does not apply in the case of money. Thus, the aim of categorically separating money from nonmoney could never be successfully reached.

4.3.1 Reconsidering the idea of a kind essence of money

Essentialism of natural kinds has recently been subjected to heavy criticism in philosophy of science, and its research agenda is now singled out as having taken a 'deflationary turn' (Tahko, 2015, p. 795). Some critics argue that the existence of essences upheld by essentialist interpretations of natural kinds is merely a gratuitous assumption. Others go to the empirical sciences in search of cases revealing essentialism's limited capacity to capture the actual kinds found by special sciences. Predominantly, essentialists have been criticized for interpreting natural kinds as immutable or static, while the natural sciences embrace mutable and dynamic kinds (Bird and Tobin, 2018).

In the version of traditional essentialism discussed in this chapter, the natural kind essence of an object is the set of intrinsic properties that the object must possess if it is to be a member of the kind (Ellis, 2002/2014, p. 26-27). A wide body of literature discusses what an 'intrinsic property' is without reaching a consensus. However, among the different alternatives, possibly the most popular use of the term *intrinsic* is that which expresses a notion of interiority—such as the number of protons inside the nucleus of chemical elements.[53] Using this restrictive interpretation, Ellis (2002/2014, p. 33) claims that chemical elements are genuine natural kinds; therefore, 'there is

[52] Another approach to constructing monetary statistics, which is followed by Friedman and Schwartz (1970), claims that due to the lack of a precise definition of money, a dividing line must be chosen according to the ability to deliver the best predictions of observable phenomena. As this approach distinguishes between money and nonmoney, but not by means of an allegedly defining feature of money, it does not fall within what we call *the money-or-nonmoney view*.

[53] For a fairly complete discussion, see Marshall and Weatherson (2018). For them, being cubical is intuitively an identity interiority property and being an uncle is not intuitively an identity interiority property. More formally: 'Being FF is intrinsic iff, necessarily, for any xx, if xx is FF then xx is FF in virtue of how xx is intrinsically, where "how xx is intrinsically" abbreviates "how xx and its parts are and how they are related to each other, as opposed to how xx and its parts are related to other things and how other things are"' (Marshall and Weatherson, 2018).

never a gradual transition from any one chemical kind to any other chemical kind.' Since the distinctions between chemical kinds 'are based entirely on intrinsic (interior) differences,' Ellis also holds that they are 'nature's distinctions, not ours.' However, can this perspective be extended to a social phenomenon such as money? To answer this question, we survey what monetary economists have learned about the nature of money and use that knowledge to decide whether there is a set of intrinsic (interior) properties that form the kind essence of money. Furthermore, we discuss whether there is a set of necessary and sufficient characteristics for membership in the kind 'money,' regardless of whether they are interior or exterior.

The term *money* often refers to *objects* that, as coins or bills, are used for transactional purposes. However, money can also refer to an *institutional transaction mechanism* that we use to exploit the gains from trade. Other paradigmatic instances of institutional transaction mechanisms are credit and barter. In the contemporary economy, as opposed to a pure monetary economy, various institutional transaction mechanisms coexist.[54] Rocheteau and Nosal (2017) hold that a key distinction between monetary and credit trade is that with money, the exchange is *quid pro quo* and no future obligation is involved. However, credit trades are intertemporal, which implies a delayed settlement. In practice, both mechanisms interweave, e.g., cash plays a significant role as an instrument to settle debt, while credit cards are largely used to pay for purchases. Thus, as many economists think, a term such as *means of payment*, meaning that an object can be used to pay for purchases and settle debts, is more appropriate than a term such as *medium of exchange*. [55]

Among standard monetary models, we concentrate on models in which the use of a means of payment is an outcome rather than a presupposition.[56] Note that models without money or in which the use of money is forced by the modeler (e.g., money-in-the-utility function or cash-in-advance models) can hardly provide us with information about a potential essence of money. One insight that emerges from models in which money is an outcome is that the exchange value of money is pinned down by two key factors: a-) the fundamentals of objects and b-) beliefs about their acceptability

[54]Credit has historically played an important role in the development of monetary exchange (Graeber, 2011; Semenova, 2011). Indeed, modern monetary economists are aware that the double-coincidence problem is not sufficient for finding a role for money. Only when agents cannot commit to repaying their debts or have no monitoring technology to push deviants can credit not be implemented and money becomes an essential alternative (Lagos et al., 2017).

[55]Most modern monetary economists seem to agree that the primary function of money is to be a medium of exchange (Wallace, 2008; Clower, 1967). Samuelson's (1958) overlapping generations model explains money as a store of value. As Hoover (1996, p. 212) says, the unit of account is 'traditionally regarded as the weak sister of the famous triad.' Marx's (1867/1906) notion of general equivalent is reminiscent of the role of money as a unit of account. More recently, Doepke and Schneider (2017) wrote a model of money as a unit of account.

[56]For money as an outcome, see Kiyotaki and Wright (1989; 1991), who explored settings in which agents meet bilaterally at random and found an equilibrium where an object is used a means of payment. Shi (1995) and Trejos and Wright (1995) relaxed the assumption of indivisible goods and let agents bargain on terms of trade. More recently, Lagos and Wright (2005) built a tractable model of divisible money. This literature is surveyed in Lagos et al. (2017), Rocheteau and Nosal (2017), and Williamson and Wright (2010b).

in trade. Consider, for instance, an environment without fiat money but instead with various objects that differ in their storage costs. If individuals are guided only by fundamentals, the object with the lowest storage cost will be accepted as a means of payment. However, theory also predicts that agents can end up in a speculative equilibrium in which the good with the highest storage cost circulates as a means of payment. This can happen as long as the object is believed to be widely accepted. Such a prediction, already tested in the laboratory (Duffy and Ochs, 1999; Duffy, 2001; Duffy and Ochs, 2002), weakens the claim that acceptability of a means of payment relies exclusively on fundamentals. Accordingly, the acceptability of a means of payment in trade can be primarily driven by self-fulfilling beliefs.

Monetary economists sometimes use the term fundamentals to refer to explicitly physical characteristics that explain the fundamental value of an object. Nevertheless, we think that the term fundamentals also names factors that exceed the interior properties of objects used as money. Thus, for instance, although storage costs entail a physical dimension (e.g., size and durability), storage costs can substantially vary as a result of a transformation in the available storage technology while leaving objects' physical characteristics unchanged. Additionally, the present value of future payoffs can, to some extent, be determined by the physical characteristics of assets. However, these payoffs are also largely determined by aspects that can be considered *exterior*, such as individual preferences, interest rate, or asset volatility. Fundamentals thus do not qualify as an *interior* property of money.[57]

For an object to circulate in trade as a means of payment, individuals must hold beliefs about its acceptability. Thus, the institutional object called money consists of both the physical elements of the physical object and individuals' beliefs that such an object will be accepted in trade. In such a way, while not part of the physical object, beliefs about acceptability are a property of the institutional object called money. However, are these beliefs an intrinsic property? We think that, rather than an interior property, beliefs about acceptability imply a complex network of exterior relations of money holders with other institutions and social conventions that decisively define the acceptance of a means of payment. That political and cultural as well as institutional and historical factors shape beliefs about the acceptability of a means of payment is not alien to monetary economists. As Kiyotaki and Wright (1992, p. 19) observe, 'acceptability may not actually be a property of an object as much as it is a property of social convention.' Just like fundamentals, beliefs about acceptability are not an interior property of the institution of money.

Interior properties play a role in explaining the use of an object as a means of payment. However, membership in the kind 'money' is largely defined by exterior relations of objects and individuals with the determinants of fundamentals and beliefs about acceptability. The fundamental value of gold is not only determined by its chemical qualities but also reflects the exterior relations between the interior properties

[57] This result is, of course, not surprising as the general concept of value, in economics, is not an intrinsic property of objects, so it is highly implausible that the idea of an interior property of money can be made to work.

of gold and the prevalent desires and cultural practices of our society (Smit et al., 2011). The launching of a new currency is an example of the complexity of exterior relations that shape beliefs about the acceptability of money (Selgin, 1994; Lotz and Rocheteau, 2002).[58] Despite the sophisticated institutional design implemented by the Eurozone, which is in itself evidence of this complexity, it has also been reported that bank customers screen the serial numbers of notes to determine the origin of issue. Such customers prefer to hold notes having a serial number beginning with X, namely, notes printed for the German Bundesbank (Evans-Pritchard, 2008). Fundamentals and beliefs are thus not independent of the histories, locations, and the particular social context in which a determined object is used as a means of payment.

The properties studied above are not interior properties; thus, one important requirement of traditional essentialism is not met. However, another question remains: Can we identify a list of necessary and sufficient characteristics, whether interior or exterior, for membership in the kind 'money'? Although we have remarked that the positive exchange value of money depends on fundamentals and beliefs, we do not regard them as the set of necessary and sufficient characteristics that allow one to categorically separate money from nonmoney. A simple comparison between commodity money and fiat money system confirms this. While the value of commodity money is backed by its properties as a commodity (Burdett et al., 2001; Chapter 5), the same does not hold true for, say, dollars, or any other form of contemporary national currency whose discounted stream of dividends (or fundamental value) is zero. Furthermore, there are assets that, even though their fundamental value is positive, are never used as a means of payment but rather as a store of value.

Another alternative could be to interpret the function of means of payment as the necessary and sufficient condition for membership in the kind. We think that such a functional kind is a viable alternative.[59] However, a crucial difference from traditional essentialism is that even in that case, there will always be some vagueness in the kind. Recall that the function of means of payment can be performed with credit; also, as we will show in section 4.4, the function of means of payment is a matter of degree and not of kind. Therefore, the goal of a clear-cut distinction between money and nonmoney cannot be achieved. In the rest of the chapter, we will not embark on the task, which we think is doomed to fail, of checking a list with all the necessary and sufficient characteristics that have ever been proposed to clearly separate money from nonmoney. We ignore the existence of such a list and are skeptical about the possibility not only of producing it but also of using it to unambiguously demarcate the extension of the natural kind 'money.' If we followed that path, we would arrive at the start of the chapter and the question about the defining characteristic of money to establish, for example, whether bitcoin is or is not money.

[58] Chapter 5 will also show that the exchange value of an illegal means of payment is affected by law-enforcement policies.

[59] Functionalism about natural kinds was discussed in Chapter 3.

4.3.2 Some additional consequences and alternatives

Because of the difficulties in finding a natural essence of money, it is not surprising that the measurement of money is not free of arbitrary classificatory practices. Whereas every central bank in the world agrees on the inclusion of official currency in the measure of monetary aggregates, there are many other financial instruments for which the inclusion decision is not plain. Despite global efforts to standardize measurement practices, it is explicitly acknowledged that the final decision depends on the circumstances of each nation (International Monetary Fund, 2016). This inevitably leads to discrepancies between countries over what is considered money. The Bank of England (BE) adopts an institutional definition of the money-creating sector that excludes units or shares issued by Money Market Funds from broad monetary aggregates. For its part, the European Central Bank (ECB) includes money market funds' products in its statistics, as the ECB's definition of money follows a functional criterion (Burgess and Janssen, 2007). We thus find that the same financial instrument both is and is not money, depending on the money-creating sector definition that is adopted. In the same vein, central banks disagree about the maturity cut-off point of financial instruments. The idea is that long-term instruments should not be included in broad money because they are mainly used for saving rather than for transactional purposes. However, how long does the short term last? The honest answer is that no one knows exactly. The BE employs a maturity cut-off of up to five years, the ECB up to three years, and the Federal Reserve has no maturity cut-off.

We have argued that, based on what is known from modern monetary economics, we cannot identify a set of interior properties that form the natural kind essence of money. We have also pointed out that it has not been possible to identify a set of necessary and sufficient characteristics, whether exterior or interior, for membership in the kind 'money.' A corollary is that economists cannot define the kind membership independently of exterior relations and arbitrary classificatory practices. There is nothing in the nature of money that can be interpreted as a natural kind essence that one could use to sharply separate money from nonmoney, as idealized by *the money-or-nonmoney view*. We conclude then that while the version of essentialism evaluated here could apply to chemical elements, it does not apply to the institution of money. This conclusion may be palatable even to contemporary supporters of traditional essentialism who can readily admit that essentialism is restricted to the natural kinds of chemistry and particle physics (Ellis, 2002/2014). Our main point, however, is not aimed at philosophers who are already persuaded of the limits of traditional essentialism. Rather, we aim to show that economists of *the money-or-nonmoney view* do not seem to be aware of what, from a general perspective, would be required to implement an unambiguous classification of things into money and nonmoney. Without what is called a natural kind essence of money, the classificatory purpose of *the money-or-nonmoney view* cannot be successful.

There is an alternative approach to analyzing high-level systems as biological organisms or social systems that seems to be more promising than traditional essentialism. The alternative is Richard Boyd's (1999) homeostatic property cluster

(HPC) theory of natural kinds. In this theory, the different properties of a natural kind are highly correlated so that they form a cluster of properties. The presence of a property in the cluster makes the presence of another property highly probable. Remarkably, Boyd's HPC theory does not require us to assume, as traditional essentialism does, that there is a natural kind essence that is an intrinsic property of all of a kind's members—as in the case of the atomic structure of an element or the DNA of a biological species. HPC theory thus permits exterior relations to play a noteworthy role in inducing similarity among the members of a kind. In the case of species, both the interior properties and exterior relations of organisms are significant causes of species-wide similarities (Ereshefsky, 2017).

Boyd's theory is able to accommodate the idea that money is both the result of objects' interior properties that serve as instances of this institution and the exterior relations of objects and individuals with the factors that determine fundamentals and beliefs about acceptability. Guala (2016b; 2016c) employed Boyd's theory to assert that money is a natural kind that is grouped according to its functional properties. For Guala (2016c), the three standard functions of money are correlated, as they solve a cluster of related problems. Interestingly, this interpretation of money is in line with our claim that there is no kind essence of money that allows us to categorically separate money from nonmoney. Boyd's theory admits a certain degree of vagueness and conventionality in drawing the boundaries of natural kinds because some individuals cannot possess one or more properties of the cluster.

The role given to money in economics has been a particularly disputed issue in the discipline (Hoover, 1996). Historians of economics have even suggested that the opposition between 'real' and 'monetary' analysis could be a foundational divide in economics (Schumpeter, 1954, p. 276; Cartelier, 1985, p. 64). The disputability of money could then give the impression that our conclusions substantially depend on the type of monetary theory that we used to criticize the traditional essentialism endorsed by *the money-or-nonmoney view*. Beyond the reasons one could have for preferring one theory or another, we believe that our argument is sufficiently robust to hold true even when another respectable theory of money is used. Although we do not discuss the heterodox monetary approach in detail, we do not think that it is supportive of a traditional essentialist interpretation of money. We simply remark that this approach has, for a long time, explicitly insisted upon the historical part played by the state in the implementation of a means of payment (Knapp, 1924; Smithin, 2000; Wray, 2014b). Additionally, within this approach, Ingham (2004) has claimed that money is a social relation that involves a promise between the issuer and the user of money. Since these characteristics can hardly be regarded as intrinsic properties that are necessary and sufficient for a thing to be money, our sense is that our point against *the money-or-nonmoney view* is secure.

4.4 The liquidity degree view: an outline

In opposition to *the money-or-nonmoney view*, we introduce what we call *the liquidity degree view*. As the multiple objects that circulate as means of payment differ in their degree of acceptability, *the liquidity degree view*, instead of proposing an absolute standard of liquidity, emphasizes that there is a scale of liquidity. It should be noted that economists belonging to *the liquidity degree view* are not the only ones claiming that objects used to facilitate transactions have different degrees of liquidity. After all, Menger (1892) spoke of different degrees of saleableness, and Yeager (1968) mentioned differences in degree among distinct media of exchange. However, as mentioned above, they believed that such differences ceased to be gradual to become merely a difference in kind. Therefore, what actually sets apart *the liquidity degree view* is that it does not hold that a difference in liquidity degree transforms into a difference in kind. Accordingly, *the liquidity degree view* does not postulate any theoretical principle or absolute standard of liquidity based on which one could categorically determine that one group of objects must be called money while the other must be called nonmoney. In this section, we do not make a comprehensive presentation of *the liquidity degree view*. Instead, we just aim to outline some of its features and implications.[60]

To introduce the idea of a liquidity value, we build again on the same type of monetary economics we have used until this point.[61] As shown above, the value of an object serving as a means of payment is not just pinned down by its fundamental value. To the extent that an object is accepted in trade because people believe in its acceptability, the object is also valued for its usefulness in facilitating the exchange. This usefulness can be interpreted as the liquidity value of a means of payment. Returning to the example of a dollar bill, although no dividend is paid, it is positively priced due to its widespread acceptability that makes trade much easier. However, if the price of the simplest of assets is so determined, it means that the liquidity considerations might matter for the pricing of other assets that are also used as means of payment. Consider a case in which fiat money is perfectly recognizable, while for the other assets, agents cannot differentiate between authentic and fraudulent assets. If the cost of counterfeiting were low enough, a large number of phony assets could be produced, and agents would prefer not to accept any asset in trade. Assets become fully illiquid, and their price only reflects the fundamental value. In contrast, if no phony asset were produced, assets would circulate alongside fiat money, and their prices would exceed the fundamental value, thereby reflecting a liquidity premium (Lagos et al., 2017; Rocheteau and Nosal, 2017).[62]

[60] Recall that the analysis of liquidity considered in this chapter has mainly focused on the function of means of payment. However, I believe that the argument presented applies to both exchange liquidity and market liquidity.

[61] For an alternative presentation of liquidity, see Foley (1989), Minsky (1986/2008), and Bell (2001). This literature introduces the idea of different degrees of acceptability postulating the existence of a hierarchy of liabilities. Bell (2001) conceives of the hierarchy as a four-tiered pyramid, where in each tier there is a sector of the economy depending on the degree of acceptability of its liabilities.

[62] The idea that the rates of return may depend on liquidity value has been used by modern monetary

Liquidity is valued according to the degree to which an object is accepted for transactional purposes. In an extreme case, the liquidity of an object could be practically nil, as was the case of Hungarian banknotes under hyperinflation in 1946. In another extreme case, one could imagine a banknote issued by the Central Bank of the Earth, which is valid as a means of payment in the global economy, that is, an object having an extremely high liquidity. Between these two extreme cases, what we observe in actual economies is the coexistence of many and various objects that circulate as means of payment, although they have different levels of acceptability. As Keynes (1936/1949, p. 239-240) put it, liquidity is 'a matter of degree,' so that 'there is, clearly, no absolute standard of "liquidity" but merely a scale of liquidity.' Similarly, Friedman and Schwartz (1970) maintain that assets may provide the joint products of moneyness and interest-payingness. In Friedman and Schwartz's terminology, moneyness refers to the capacity of an asset to serve as a medium of exchange. They opine that it is possible to regard 'each asset as a joint product having different degrees of "moneyness"' (Friedman and Schwartz, 1970, p. 151).[63]

Banknotes, treasury bills, mortgage-backed securities, mutual fund shares, shells, stones, cattle, and cigarettes are all examples of objects that have or have had some positive rating on the scale of liquidity. For the reasons already presented, therefore, the level of liquidity is not given *a priori*, but it is rather the result of the exterior relations of objects and individuals in a particular social context that shape the preferences of acceptability in transactions of a given object. On this subject, Keynes (1936/1949, p. 240) claims that 'the conception of what contributes to "liquidity" is a partly vague one, changing from time to time and depending on social practices and institutions.' The position of an object, new or already existing, on the liquidity scale is to be modified based on whether certain factors that are relevant to determining its acceptability in payments are changed.

The liquidity degree view does not hold that there is a critical threshold of acceptability with which one can categorically separate money from nonmoney. Since acceptability remains a matter of degree and not of kind, liquidity cannot be used to sharply demarcate the borders of an allegedly natural kind designated by the term money. The Committee on the Working of the Monetary System in the United Kingdom was set up in 1957 under Lord Radcliffe to make recommendations on the working of the monetary and credit system. Its report known as the Radcliffe Report and published in 1959 claimed that the objective of monetary policy was not to control or influence the money supply, narrowly defined, but the overall liquidity position of the economy (Committee, 1959). According to Cramp (1962, p. 5, 14), the Radcliffe Report 'conceives of a wide range of assets capable of performing in varying degree the essential monetary functions,' and he also added that 'the Radcliffe case rests on the impossibility of finding a clear-cut line of division between monetary and nonmonetary

economists to explore the problem of the coexistence of fiat money with interest-bearing assets. This is an old problem remarked upon by Hicks (1935) and frequently ignored by the Walrasian tradition of money.

[63]Since moneyness is consistent with the modern notion of liquidity, contemporary monetary economists often use the term moneyness as an alternative formulation of liquidity value.

assets.' Likewise, Sayers (1960, p. 176), a member of the Committee, wrote that 'there is no single asset or group of assets that uniquely possesses a uniform monetary quality that is totally absent from all other assets.' While the Radcliffe Report is an explicit instance of what we call *the liquidity degree view*, the theoretical influences of the Report seem to stretch back to the Banking School (Sayers, 1960). In showing the parallel between the debates that the Radcliffe Committee was involved in and those of the Currency and Banking Schools, Cramp (1962, p. 5, 11) pointed out that,

> On the one hand, we have the Currency/orthodox conception of a clear line of demarcation between money and near-money, with the latter in an important sense dependent on the former. Against this is the Banking/Radcliffe view that any demarcation line is arbitrary, with the emphasis on the wide degree of substitutability across the whole liquidity spectrum.

We do not wade into the controversy between the Currency and Banking Schools. Although the above quote suggests that they are early exponents of *the money-or-nonmoney* and *liquidity degree views*, careful historical work will be required before coming to a solid conclusion. In the blogosphere, JP Koning (2013) has rescued Hayek's view on the divide between money and nonmoney, which is particularly enlightening. As Hayek (1976/1990, p. 56, italics in the original) explains,

> Although we usually assume there is a sharp line of distinction between what is money and what is not—and the law generally tries to make such a distinction—so far as the causal effects of monetary events are concerned, there is no such clear difference. What we find is rather a continuum in which objects of various degrees of liquidity, or with values which can fluctuate independently of each other, shade into each other in the degree to which they function as money.
>
> I have always found it useful to explain to students that it has been rather a misfortune that we describe money by a noun, and that it would be more helpful for the explanation of monetary phenomena if 'money' were an adjective describing a property which different things could possess to varying *degrees*.

The refusal to draw a sharply defined line between money and nonmoney also seems to be shared by contemporary monetary economists. Williamson and Wright (2010a, p. 294), within the context of a theoretical model in which third-part liabilities facilitate transactions, concluded that 'we see no real purpose in drawing some boundary between one set of assets and another, and calling members of one set money.' Likewise, in a post-Keynesian analysis of the shadow banking system, Nersisyan and Dantas (2017, p. 285) claimed that they 'refer to the liabilities denominated in the money of account by their specific names—coin, currency, deposits, commercial paper, Eurodollars, etc., without carving out a subset of liabilities and calling it "money".'

While economists belonging to *the liquidity degree view* agree that a clear-cut distinction between money and nonmoney is not possible, they strongly disagree on many theoretical and policy issues. The fact that they are grouped into a single

view does not intend to downplay the diversity and richness of their analysis. Indeed, it could be the case that a detailed historical research that elaborates on their disagreements finds a classification more fine-grained than the dualistic framework proposed in this chapter. However, we believe that if one takes the insights of these economists seriously, one result is that the essentialist impulse to categorically separate money from nonmoney must be resisted.

With respect to the practice of speaking about money as a noun, we recall that a work of science helps us debug folk practices that provide us with an incorrect image of the world.[64] Is bitcoin money? Using their strategy, which was mentioned in section 4.3, Smit et al. (2016, p. 333, italics added) conclude that 'it is reasonably clear that the answer is *no*.' Nonetheless, they also mention that 'we could say that bitcoin may become money at some point, and we could say that bitcoin is already money among those who use it to transact.' For them, then, bitcoin is money and nonmoney at the same time. The analytical shift proposed here in favor of *the liquidity degree view* yields an immediate payoff. Once we do not derive from bitcoin's low liquidity degree the statement that bitcoin is not money, it spares us making the contradictory claim *à la* Smit et al. (2016) that even though bitcoin is not money, it is money for those who use it in transactions. At the moment, bitcoin is not used as a production input, nor is it directly consumed, namely, its fundamental value is zero. However, as discussed above, assets can be positively valued based on the beliefs or expectations of market participants. Bitcoin's present price 'is determined solely by expectations about its future price. A buyer is willing to buy a bitcoin unit only if he or she assumes that the unit will sell for at least the same price later on' (Berentsen and Schär, 2018, p. 7). Although bitcoin has been promoted as a substitute for traditional currency, the available evidence reveals that so far, it has performed poorly as a means of payment. Seen through the lens of *the liquidity degree view*, we believe that the question about whether bitcoin is or is not money should be abandoned. Bitcoin can be described as a means of payment with a poor degree of acceptability.[65]

The implications derived from *the liquidity degree view* are nonnegligible. Among other things, the very notion of what can be called money is questioned, as is the attempt to draw an indisputable dividing line between money and nonmoney. *The liquidity degree view* agrees with Boyd's HPC theory that there is some vagueness when establishing the boundaries of natural kinds. However, while on Boyd's theory, this vagueness results from the lack of possession of one or more properties by some

[64] At the suggestion of a reviewer regarding this point, we refer to Ladyman and Ross's (2007) book; they develop a hard criticism of the philosophical reflection that relies exclusively on old-fashioned science, common sense, and day-to-day intuitions. Regarding the nature of money, we believe that to a certain extent there has been an undesirable combination of the one criticized by Ladyman and Ross and a deficient philosophy practiced by celebrated economists, such as those of *the money-or-nonmoney view*. Certainly, an equilibrium between the best of the two worlds is what seems preferable.

[65] The total number of bitcoin transactions in 2017 amounted to less than one-tenth of one percent of the total electronic commerce transactions (Fox, 2017). In addition, according to information reported by the 17 largest crypto merchant-processing services, the use of bitcoin to buy and sell goods and services continues to fall (Kharif, 2018). For a discussion of possible alternative uses for bitcoin, see Andolfatto (2016), Koning (2018), and Williamson (2018).

individuals, on *the liquidity degree view*, the vagueness arises because money is an institution characterized by the possession of the property of liquidity that comes in degrees. Whether the possession in degrees of any type of property or set of properties is an idea that can be generalizable to other institutions is something still to be determined. However, this could be a case where the methodological problems of economics provide us with a heuristic to think about larger issues within the philosophy of social sciences.

Does *the liquidity degree view* imply that economists cannot call a group of means of payment, for lack of a better word, money? No. Following in the footsteps of Friedman and Schwartz (1970, p. 137), we think that an alternative is the creation of dividing lines that are established as a matter of convenience depending on the purpose of their use: testing a hypothesis, building a simplified model, predicting a phenomenon, designing a policy, or regulating an activity. In each case, the motivating purpose arises from the particular needs of the people in charge of studying and managing monetary issues.[66]

As our theories of money develop further, so too will our classifications of money. The pioneering work of Friedman and his students (1956), subsequent works such as the one by Friedman and Schwartz (1970), and the development of a typology of M0, M1, and M2 represent great achievements in the effort to produce better monetary statistics. Today, it is a widespread practice to measure money through simple sum monetary aggregates in which each asset is treated as a perfect substitute for all other assets. Although Friedman and Schwartz (1970) used this type of aggregation, they cautioned that a more sophisticated method implied a weighted sum of assets, that is, an aggregation in which the different components are added up with weights reflecting the different degrees of moneyness. Divisia monetary aggregates represent an alternative to simple sum monetary aggregates (Barnett, 1980, 1982). Interestingly, empirical exercises that use Divisia aggregates find results that contradict the current unanimity that monetary aggregates are not helpful for monetary policy and business cycle analysis (Hendrickson, 2014). *The liquidity degree view* can bring new insights by revisiting the discussion, often overlooked, of simple sum monetary aggregates and weighted monetary aggregates.

[66] Keynes (1936/1949, p. 167) seems to agree with this position: 'We can draw the line between "money" and "debts" at whatever point is most convenient for handling a particular problem.'

Chapter 5

Coca-Base Money: Anti-narcotics Policy and Exchange Value

5.1 Introduction

In coca-growing regions of Colombia, coca-base is used as a means of payment. These regions are located in remote areas which lack the institutional presence of the state, adequate transport infrastructure, and legal economic opportunities. Farmers mainly derive their income from sales of coca-base to large-scale cocaine producers, who then transform the coca-base into cocaine. However, during dry seasons or when coca-base buyers cannot frequently visit the region, farmers undergo an official currency shortage (Villalon, 2004). The coca-base itself then becomes a widely used means of payment that circulates alongside the official currency. In describing the phenomenon, the photojournalist Villalón (2004, p. 40) writes,

> The customer ahead of us had put a bag of cocaine base on the counter to pay his bill. I soon learned that merchants all over the region accepted base as payment for purchases, weighing out the right amount and handing back the remainder of the base in change.

Another description is provided by the anthropologist Espinosa (2010, p. 52, free translation),

> Mrs. Cristal sells beef. Every week she buys a cow, on Fridays slaughters it, and on Saturdays sells it by the pound to the neighbors and farmers who stop on their way to the village[.][...] [A]s the money in circulation is scarce, the price of beef, wages, supplies, food and many other items in the region are measured in coca[-base] grams.[...] People pay Mrs. Cristal in coca-base grams for beef, and she pays the original owner of the cow in the same manner.

The stages of cocaine production and trafficking span from the growing of coca-leaf to wholesale cocaine trade. The early stages of coca cultivation and coca-base production are mainly carried out by farmers, while the later stages of trafficking involve illegal armed groups and organized crime. In a great number of coca-growing regions, over half of coca-plant farmers do not sell the coca-leaf as-is but, instead, convert it into coca-base (Mejía and Rico, 2010; UNODC, 2018). Coca is a small plant whose time until harvest takes between two and six months, depending on the variety. The process of transforming the coca-leaf into coca-base starts with the coca growers baking the leaves under the sun. Once they are sufficiently dried, the leaves are minced and mixed, in several steps, with gasoline, cement, urea, and lime to extract the alkaloid (cocaine sulfate). The result is of this first chemical process is a brown and gelatinous mix called coca-paste. In a second chemical process, the coca-paste is mixed with, among other inputs, gasoline, sulfuric acid, sodium carbonate, and ammonium to eliminate the impurities. The resulting product of this second process is the coca-base.

Available evidence collected before the peace agreement with the FARC (Fuerzas Armadas Revolucionarias de Colombia) guerrilla group reveals that the market for coca-base has behaved as a monopsony in which the only buyer is the illegal armed

group that exerts territorial control. Mejía and Rico (2010) point out that this market's feature could explain why, even with variations in supply, the price of coca-base remained stable over several years. Illegal armed groups buy the coca-base from coca-plant farmers through intermediaries who visit the region regularly (Jansson, 2006). Coca-base is then sold to large cocaine producers who transform it into cocaine, which it is mainly shipped to markets in North America and Europe.

Colombia's government has implemented two different types of policies aimed at curbing the supply of cocaine (Mejía, 2015). The first attacks the coca cultivation by aerial spraying campaigns and manual eradication of illegal crops. The second, in contrast, attacks the later stages of production and trafficking through interdiction strategies such as the seizures of coca-base and cocaine. Aerial spraying has been the main strategy to control the cocaine supply, however, in the last decade interdiction strategies have been strengthened.

Cocaine seizures represent an economic loss for cocaine producers and drug-traffickers, while coca-base seizures are mainly a loss for coca-plant farmers. Between the years 2000 and 2017, coca-base seizures per year increased from 19.000 to 52.390 kg (ODC, 2019). Since coca-base is not only sold to cocaine producers but used as a means of payment for internal trade, a natural question that arises is this: How does an anti-narcotics policy such as coca-base seizures affect the exchange value of coca-base in internal trade? The aim of this chapter is to answer this question with a model in which agents decide endogenously to accept coca-base as a means of payment. Once such an effect has been characterized, the model allows one to study further questions: What is the effect of coca-base seizures on the effort agents put to meet a trading partner? To produce coca-base? Do agents produce more or less coca-base when there is a higher probability of suffering a seizure? The model shows that an increased probability of suffering a seizure lowers the exchange value of coca-base, and thus leads to a reduction in the search intensity, production intensity, and the stock of coca-base produced by the economy. While questions concerning the production of inputs for cocaine have been already studied by the existing literature on drug-trafficking, the novelty of the chapter is that it proposes a different mechanism through which the anti-narcotics policy can affect the production of coca-base, namely, the exchange value of coca-base in internal trade.

Search models of money are particularly adequate for the purpose of this chapter as they explicitly represent the exchange frictions that give rise to the use of a means of payment. Furthermore, the idea of a decentralized trade where agents search for trading partners fits with the above description of trade by Espinosa (2010). In this chapter, coca-base and fiat money are indivisible but agents bargain over the quantity to be produced in trade as in Shi (1995) and Trejos and Wright (1995). While the assumption of indivisible assets is made for simplicity, one could study divisible assets such as in the Lagos and Wright (2005) model.

The study of commodity money with search theory was pioneered by Kiyotaki and Wright (1989) who built a setting in which various commodities have distinct storage costs. Velde, Weber, and Wright (1999) wrote a model of commodity money

to study both the conditions under which Gresham's law holds and the mechanics of a debasement. Burdett, Trejos and Wright (2001) analyzed how cigarettes became money in prisoner-of-war camps. Their model determines the circumstances under which agents stop consuming cigarettes and, instead, use them as a means of payment. Bignon and Dutu (2017) built a model in which metal coins are imperfectly recognizable but whose intrinsic content can be assessed with a coin inspection technology. In this literature a commodity money can generate utility from either its direct consumption or the holding of the asset, or disutility as a result of a storage cost. This chapter differs in that I model coca-base as an illegal commodity money which cannot be consumed, has no storage cost, and does not generate any flow utility when agents simply hold it. Since the intrinsic content of coca-base serves as an input for cocaine production, in the model cocaine producers buy the coca-base for an exogenously fixed amount of goods.

Illegal monies are studied by Soller-Curtis and Waller (2000) in a model where domestic and foreign currencies can coexist, but there are legal restrictions on the use of foreign currency for internal trade. Lotz and Rocheteau (2002) and Lotz (2004) analyzed the launching and adoption of a new fiat money when the old money is declared illegal by the government. A common feature of these works is that the government monitors transactions to avoid the use of the illegal currency. However, there is no available evidence of such a policy from Colombia's government, and so it is not included here. With respect to the literature of illegal money, this chapter adds the study of search intensity, production intensity, and occupation choice.

In regards to search intensity, the chapter relates to Li (1995) who analyzed the effect of inflation on search intensity in a model with indivisible goods and indivisible money. In his model, when a government agent encounters a money holder, they confiscate his money balances. While Li interprets such a confiscation as an inflation-like tax, in this chapter the probability of suffering a confiscation represents naturally the anti-narcotic policy of coca-base seizures. Rocheteau and Lagos (2005) studied the effects of anticipated inflation on the frequency with which agents trade considering both bargaining and competitive price posting. Qian, Wang, Wright (2011) focused on the extensive rather than intensive margin of search by adding a free entry decision by buyers. For occupation choice, I follow Choi and Rocheteau (2019) who developed a model for monies produced privately (e.g. cryptocurrencies) in which agents can choose between becoming miners or producers.

5.2 The basic model

5.2.1 Environment

The environment is based on that of Shi (1995) and Trejos and Wright (1995). Time is continuous and goes on forever. The economy is populated by a $[0, 1]$ continuum of infinite-lived agents. There is a perishable consumption good q which is produced in different varieties, is divisible, and is nonstorable. Each agent is specialized in the production of a variety that is different from the one he wants to consume; agents thus

search for trading partners.

Agents meet bilaterally according to a random matching process. The Poisson arrival rate of potential trading partners for each agent is $\alpha > 0$. There are $J \geq 3$ varieties of the consumption good and J types of agents. The distribution of agents between the different types is uniform. An agent of type $j \in \{1, ...J\}$ produces variety j but only consumes variety $j + 1$ (modulo J). These assumptions about preferences and specialization imply that, while barter never occurs, the probability of a single-coincidence match is $x \equiv 1/J$.

There are two indivisible and durable assets, coca-base and fiat money. Both assets are storable at no cost. While coca-base, b, is an input for cocaine, fiat money, m, is an intrinsically useless object. Agents can only hold one unit of either b or m at a time. If a trade takes place, the asset holder gives the producer his unit of asset in exchange for a quantity q_i, where $i \in \{b, m\}$. The utility from the consumption of q_i units of good for a unit of asset is $u(q_i)$, where $u(0) = 0$, $u'(q_i) > 0$, and $u''(q_i) < 0$ for all $q_i > 0$. There is a value $\hat{q}_i > 0$ such that $u(\hat{q}_i) = \hat{q}_i$ and a value q_i^* that solves $u'(q_i^*) = c'(q_{q_i}^*)$. Agents discount future utility at rate $r > 0$.

Let A_i be the measure of agents holding an asset $i \in \{b, m\}$ with $A = A_b + A_m$, so that $1 - A$ represents the measure of agents without assets who are called producers. Because the assets are indivisible and their holdings are restricted to $\{0, 1\}$, A_b and A_m are also measures of both the stock of coca-base produced by the agents $b \in (0, 1)$ and the exogenously fixed stock of fiat money $m \in (0, 1)$. Agents with assets must consume before producing.

If a producer meets a trading partner, which occurs with probabilities per unit of time $\alpha x A_b$ and $\alpha x A_m$, he operates his technology to produce instantaneously q_i units. The disutility cost from production is $c(q_i) = q_i$. A producer also encounters a coca-leaf crop according to a Poisson process with arrival rate $\lambda > 0$. When this occurs, he temporarily gives up on his technology to produce q and operates an alternative technology to produce instantaneously one unit of coca-base at zero disutility cost.

An agent holding coca-base can encounter two additional events. First, he meets an intermediary according to a Poisson process with arrival rate $\phi > 0$. Whenever this happens, the agent with coca-base chooses between selling the unit of coca-base or holding it. If coca-base is sold, the intermediary produces an exogenously fixed quantity $\bar{q} > 0$ of the variety preferred by the seller. Otherwise, the latter goes on his way, still holding his unit of coca-base. Second, according to a Poisson process with arrival rate $\delta > 0$, a coca-base holder can meet a counter-narcotics official who seizes and destroys the unit of coca-base.

Since time is continuous, two or more events cannot occur at the same time. Agents lack commitment and there is no public record of agents' trading histories nor technology to enforce private debt contracts. Credit thus cannot be implemented.

5.2.2 Returns to search

Let V_p and V_i, where $i \in \{b, m\}$, be the value functions for producers, coca-base holders, and fiat money holders. Given that producers are willing to trade goods for

both type of assets, which is checked below, the expected returns to search for producers and asset holders can be written as

$$rV_p = \alpha A_b x(V_b - V_p - q_b) + \alpha A_m x(V_m - V_p - q_m) + \lambda(V_b - V_p) \tag{10}$$

$$rV_b = \alpha(1 - A)x[u(q_b) + V_p - V_b] + \delta(V_p - V_b) + \phi \max\{[u(\bar{q}) + V_p - V_b], 0\} \tag{11}$$

$$rV_m = \alpha(1 - A)x[u(q_m) + V_p - V_m]. \tag{12}$$

Consider first a producer. Equation (10) sets the flow return rV_p equal to the sum of three terms. The first two terms are the rate at which a producer meets an asset holder who likes the good he produces, $\alpha A_i x$, times his net gain from trade, which is the gain from switching from the role of producer to asset holder, $V_i - V_p$, minus the cost of producing q_i units. The third term is the rate at which a producer meets a coca-leaf crop, λ, times the gain of producing at no cost one unit of coca-base and thus becoming a coca-base holder, $V_b - V_p$.

Now consider a coca-base holder. Equation (11) sets the flow return rV_b equal to three terms. The first term is the rate at which a coca-base holder meets a producer of his desired good, $\alpha(1 - A)x$, times his net gain from trade, which is the utility from consumption, $u(q_b)$, plus the switch from the role of coca-base holder to producer, $V_p - V_b$. The second term is the rate at which he meets a counter-narcotics official who destroys the unit of coca-base, δ, times the capital loss, $V_p - V_b$. The third term is the rate at which he meets an intermediary, ϕ, times the maximum value among his net gain from trade, $u(\bar{q}) + V_p - V_b$, and the payoff from not trading, 0. Equation (12) sets the flow return rV_m to a fiat money holder and has a similar interpretation to equations (10) and (11).

A stationary steady-state distribution of agents requires that the outflows of coca-base, $(\delta + \phi)A_b$, equals the inflows of coca-base, $\lambda(1 - A_m - A_b)$. Therefore, the steady-state measure of coca-base holders is given by

$$A_b = \frac{\lambda}{\delta + \phi + \lambda}(1 - A_m). \tag{13}$$

5.2.3 Equilibrium

If assets are fully accepted in trade, the following incentive compatibility constraints must hold for $i \in \{b, m\}$

$$V_i - V_p \geq q_i, V_i - V_p \leq u(q_i). \tag{14}$$

Thus, a necessary condition for the existence of an equilibrium in which assets are accepted as means of payment is $u(q_i) \geq q_i$. This condition implies that the equilibrium value of q_i lies in the interval $q_i \in [0, \hat{q}]$.

When a producer and an asset holder meet, they bargain over the quantity q_i to be traded. I assume the take-it-or-leave-it bargaining protocol. In this protocol, asset holders extract the entire trading surplus so that producers are indifferent between trading and not trading. An asset holder then makes a take-it-or-leave-it offer to the producer such that

$$V_i - V_p = q_i. \tag{15}$$

When a coca-base holder meets an intermediary, trade will occur only if $u(\bar{q}) + V_p - V_b \geq 0$. Using (15), this condition can be re-written to reflect that coca-base will only be sold to intermediaries if the following incentive compatibility constraint holds

$$u(\bar{q}) \geq q_b. \tag{16}$$

There will be therefore two values q_b^g, where $g \in \{S, F\}$, depending on if (16) holds or not. The case $g = S$ refers to the situation where the coca-base holder *sells* his unit to the intermediary, while $g = F$ denotes a situation in which he retains his asset for *future* trading. Thus, $q_b \in \{q_b^S, q_b^F\}$ such that

$$q_b = \begin{cases} q_b^S, & \text{if } u(\bar{q}) \geq q_b \\ q_b^F, & \text{if } u(\bar{q}) < q_b. \end{cases} \tag{17}$$

Replacing the take-it-or-leave-it offers for $i \in \{b, m\}$ in (10) and (11), then subtracting V_p from V_b, and assuming with no loss of generality that $\alpha x = 1$, q_b^S and q_b^F become

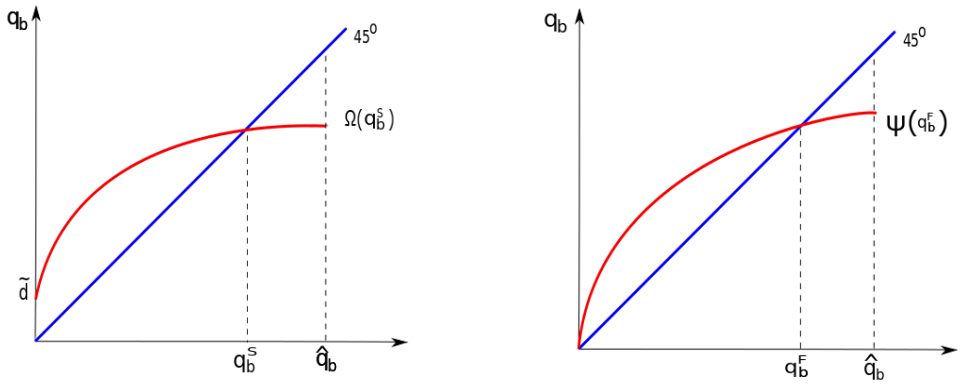
$$q_b^S = \frac{(1-A)[u(q_b^S)] + \phi u(\bar{q})}{r + (1-A) + \delta + \phi + \lambda} \equiv \Omega(q_b^S) \tag{18}$$

$$q_b^F = \frac{(1-A)[u(q_b^F)]}{r + (1-A) + \delta + \lambda} \equiv \Psi(q_b^F). \tag{19}$$

According to condition (17), if the exchange value of coca-base is lower than the perceived utility from selling the coca-base to intermediaries, coca-base holders will always trade with intermediaries when they meet. In contrast, if the exchange value is higher, coca-base holders will prefer to retain the asset for future trade with producers.

That $u(\bar{q}) > q_b$ may appear surprising as this admits the possibility of having an exchange value of coca-base that falls below its value (exogenously defined) as an input. The reason is that when a commodity can be directly consumed, the commodity holder keeps open the possibility to consume it instead of trading it when he meets with a producer of his desired good. For example, in Burdett, Trejos and Wright (2001), as long as cigarettes are sometimes consumed, their exchange value is pegged to their intrinsic value in consumption. Furthermore, coca-base is an illegal commodity thus the risk of suffering a seizure affects its exchange value. In summary, coca-base cannot be consumed and can be seized by the government. These two features prevent the value as an input, $u(\bar{q})$, from becoming a floor for the exchange value, q_b.

However, it does not follow from the above that the input value of coca-base does not play any role in supporting the acceptability of coca-base in internal trade.



(a) Trade with intermediary

(b) No trade with intermediary

Figure 5.1: Equilibrium values of coca-base

Figure (5.1a) depicts the equilibrium value of coca-base when coca-base holders and intermediaries trade. Because the coca-base is valued as an input, $\Omega(q_b^S)$ does not go through $(0,0)$ but starts at $(0,\tilde{d})$, where $\tilde{d} = \frac{\phi u(\bar{q})}{r+(1-A)+\delta+\phi+\lambda}$ is the level given by the discounted intrinsic value. As long as the exchange value contains a component of positive discounted intrinsic value, there will only be one equilibrium value $q_b^S > 0$ and coca-base will be always accepted in trade. In contrast, Figure (5.1b) shows that when coca-base holders and intermediaries do not trade, there will be two potential equilibrium values, $q_b^F = 0$ and $q_b^F > 0$. For $q_b^F = 0$ coca-base will not circulate as a means of payment, while it will for $q_b^F > 0$. Notice, however, that $q_b^F = 0$ cannot be an equilibrium since it does not satisfy the condition (17). Recall that $\bar{q} > 0$, then it cannot be the case that $u(\bar{q}) < 0$.

Therefore, an input demand for coca-base makes the acceptability of coca-base robust. On the one hand, as there is a positive discounted intrinsic value of coca-base, it rules out the existence of a nil exchange value when coca-base holders and intermediaries trade. On the other hand, even an agent who is initially retaining his unit of coca-base for future trade with producers will prefer to trade with intermediaries rather than to get a zero exchange value of coca-base. Under such circumstances, the value as an input supports that, whether sold or not to intermediaries, coca-base circulates as a means of payment. Although it will be qualified when we study the effect of coca-base seizures on the exchange value, this result allows one to capture the widely use of coca-base as a means of payment as observed in coca-growing regions of Colombia.

Following the same procedure, the equilibrium values of fiat money can be computed. Fiat money holders do not meet intermediaries, thus the equilibrium

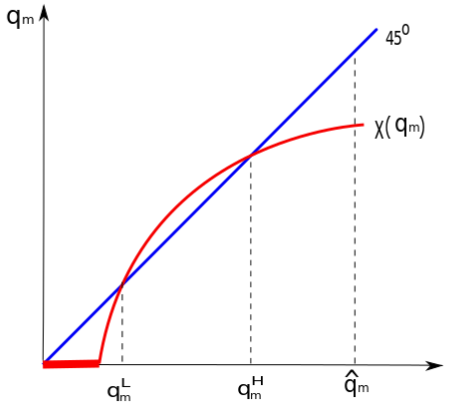


Figure 5.2: Equilibrium values of fiat money

solution q_m satisfies

$$q_m = \frac{(1-A)[u(q_m)] - \lambda q_b}{r + (1-A)} \equiv \chi(q_m). \tag{20}$$

In (20) q_m depends on q_b. The reason is that, although the assumption of take-it-or-leave-it offers makes the first two terms of V_p disappear, the discounted value of being a producer is distinct from zero. Even if asset holders extract the entire trading surplus, producers can potentially engage in the production of a unit of coca-base, which, as checked above, has a positive equilibrium value $(q_b > 0)$. An implication of this dependence is that in considering q_m to be a monetary equilibrium, it must first reach a minimum threshold of exchange value. Otherwise, accepting a unit of fiat money would imply a net loss from trade and consequently never circulate in trade. As depicted in Figure (5.2), there is always a non-monetary equilibrium when $(1-A)[u(q_m)]/\lambda \leq q_b$. In addition to this non-monetary equilibrium, there could exist one or two monetary equilibria depending on the size of q_b regarding to a critical $\tilde{q}_b$. For $q_b < \tilde{q}_b$ there are a low and a high monetary equilibria, denoted each by q_m^L and q_m^H; for $q_b = \tilde{q}_b$ there is only a monetary equilibrium ($q_m^L = q_m^H$). In case $q_b > \tilde{q}_b$, $\chi(q_m)$ lies below the 45° line and there is no monetary equilibrium. Whether the economy operates in the high or low equilibrium might be a matter of expectations. In the low equilibrium an agent produces less today because he expects that, once he becomes a fiat money holder and matches a producer, the latter will produce less for him. Conversely, in the high equilibrium an agent produces more today because he expects producers to produce more for him in the future when he becomes a fiat money holder.

5.2.4 Anti-narcotics policy

A simple policy analysis is now conducted to evaluate the potential effects of the coca-base seizures on the exchange values of coca-base and fiat money. Using condition

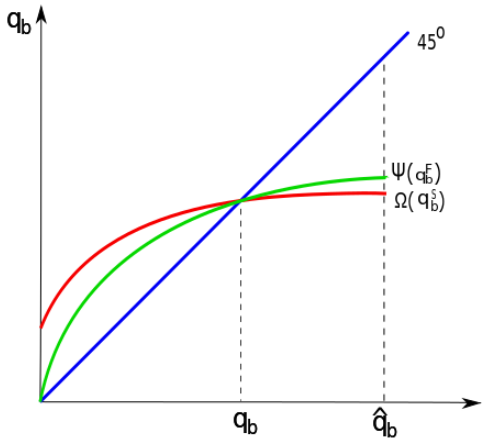


Figure 5.3: Equilibrium values of coca-base when $\delta = \delta^*$

(16), such that $u(\bar{q}) = q_b$, we can find a probability of seizure δ^* that makes coca-base holders indifferent between trading and not trading with intermediaries. It can be shown that δ^* satisfies

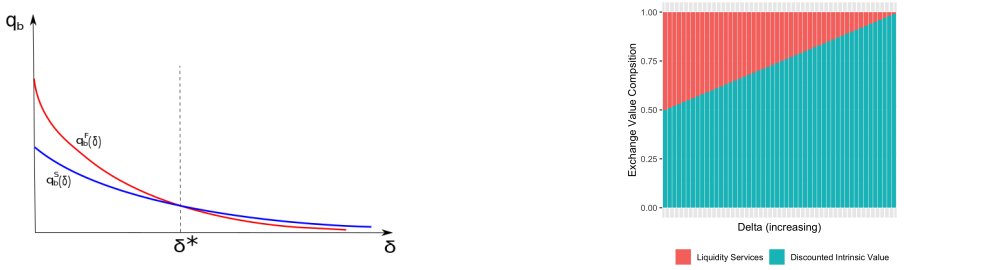
$$\delta^* = \frac{(1-A)[u(q_b) - u(\bar{q})] - u(\bar{q})[r+\lambda]}{u(\bar{q})}. \tag{21}$$

Therefore, depending on the magnitude of δ with respect to δ^*, coca-base holders then decide if they will trade or not with an intermediary according to the following condition,

$$q_b = \begin{cases} q_b^S \geq q_b^F, & \text{if } \delta \geq \delta^* \\ q_b^F > q_b^S, & \text{if } \delta < \delta^*. \end{cases} \tag{22}$$

Figure (5.3) depicts the equilibrium solutions of coca-base for $\delta = \delta^*$, so coca-base holders are indifferent between both equilibrium values ($q_b^S = q_b^F$). For $\delta > \delta^*$, $\Omega(q_b^S)$ intersects the 45° line at a higher exchange value such that $q_b^S > q_b^F$. For $\delta < \delta^*$ it is $\Psi(q_b^F)$ which now intersects the 45° line at a higher point, and thus $q_b^S < q_b^F$.

To better illustrate the relationship between the exchange value of coca-base and anti-narcotics policy, Figure (5.4a) shows q_b^S and q_b^F as functions of δ. If δ is sufficiently close to 0, the risk of a capital loss due to seizure by a government agent is low. Therefore, when meeting an intermediary, coca-base holders will retain the asset for future trade with producers as $q_b^S < q_b^F$. However, if the probability of suffering a seizure increases so that $\delta > \delta^*$, coca-base holders will always trade in meetings with intermediaries, since now $q_b^S > q_b^F$ due to the increased risk of a capital loss. Coca-base holders make their decision to trade with intermediaries according to the exchange value as determined by the perceived risk of a capital loss. Notice, however, that as δ



(a) Anti-narcotics policy

(b) Exchange value composition ($\delta > \delta^*$)

Figure 5.4: Anti-narcotics policy and exchange value

increases the exchange value of coca-base decreases, regardless of whether trade with the intermediary takes place.

As with any other commodity money, the exchange value of coca-base has two components. One corresponds to liquidity services rendered by the coca-base in facilitating trade, and the other corresponds to coca-base's intrinsic content. For $\delta < \delta^*$ the exchange value is fully explained by the liquidity service component. However, as shown in Figure (5.4b), for $\delta > \delta^*$ as δ increases the fraction of total exchange value due to liquidity services decreases and the fraction due to the discounted intrinsic value increases (although, as noted above, the total exchange value decreases). In sum, a stronger interdiction policy reduces the exchange value of coca-base and makes it converge to the discounted intrinsic value. Indeed, in the limit as $\delta \to +\infty$, q_b^S converges to $\frac{\phi u(\bar{q})}{r+(1-A)+\delta+\phi+\lambda} = 0$. Thus, only an extremely strong policy of coca-base seizures could drive coca-base out of circulation.

The welfare effects of changes in δ can be evaluated through a measure of steady state welfare. The aggregate welfare, $W = (1 - A_b - A_m)V_p + A_bV_b + A_mV_m$, is just the weighted average of values (expected utilities) across agents in the steady state. It can be shown that $\frac{dW}{d\delta} < 0$, so welfare falls as the probability of suffering a coca-base seizure increases. That is because coca-base enhances welfare by allowing production and consumption that would not exist if the anti-narcotics policy drove it out of circulation.

Finally, it should be noted that, as pointed out by Soller-Curtis and Waller (2000, p.179), an interesting feature of interdependency between means of payment is that the effect of the government policy on the illegal one will affect the value of the legal. The government sets a probability of seizure δ that defines a level of q_b. The equilibrium value of fiat q_m will then change depending on the size of q_b as shown in Figure (5.2).

5.3 Search intensity

This section shows the effects of coca-base seizures on the effort asset holders make to meet a trading partner. Thus, I assume that producers only search for coca-leaf crops, even though they can still receive trading opportunities. Asset holders choose search intensity α_i, where $i \in \{b, m\}$. The cost of search intensity is $\omega(\alpha_i)$, where

$\omega(0) = \omega'(0) = 0$, $\omega'(\alpha_i) > 0$, and $\omega''(\alpha_i) > 0$ for $\alpha_i > 0$. To reduce the number of cases, I assume $\delta \geq \delta^*$. The value functions then become

$$rV_p = \alpha_b A_b x(V_b - V_p - q_b) + \alpha_m A_m x(V_m - V_p - q_m) + \lambda(V_b - V_p) \tag{23}$$

$$rV_b = \max_{\alpha_b \geq 0}\{\alpha_b(1-A)x[u(q_b) + V_p - V_b] + \delta(V_p - V_b) + \phi[u(\bar{q}) + V_p - V_b] - \omega(\alpha_b)\} \tag{24}$$

$$rV_m = \max_{\alpha_m \geq 0}\{\alpha_m(1-A)x[u(q_m) + V_p - V_m] - \omega(\alpha_m)\}. \tag{25}$$

Equations (24) and (25) include now the cost of search intensity $\omega(\alpha_i)$. I assume again that asset holders make take-it-or-leave-it offers. The FOCs for α_i associated to (24) and (25) are given by

$$\omega'(\alpha_b) = (1-A)x[u(q_b) - q_b] \tag{26}$$

$$\omega'(\alpha_m) = (1-A)x[u(q_m) - q_m]. \tag{27}$$

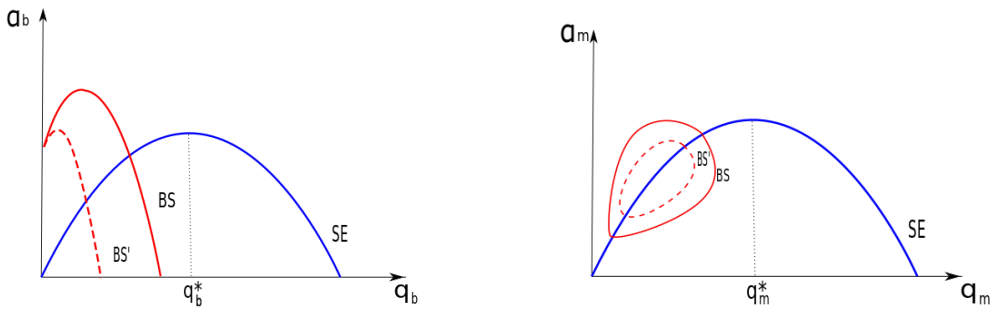
Equations (26) and (27) equate the marginal cost of search intensity with the expected marginal benefit from search. Each of these equations define a search effort (SE) curve in (q_i, α_i) space, where $i \in \{b, m\}$. Furthermore, bargaining implies the following relations

$$q_b = \frac{\alpha_b(1-A)x[u(q_b)] + \phi u(\bar{q}) - \omega(\alpha_b)}{r + \alpha_b(1-A)x + \delta + \phi + \lambda} \tag{28}$$

$$q_m = \frac{\alpha_m(1-A)x[u(q_m)] - \lambda q_b - \omega(\sigma_m)}{r + \alpha_m(1-A)x}. \tag{29}$$

Equations (28) and (29) define a bargaining solution (BS) curve in (q_i, α_i) space. Equilibrium is a pair (q_b, α_b) solving (26) and (28), and (q_m, α_m) solving (27) and (29).

Figure (5.5a) depicts the effect of a higher probability of seizure on the equilibrium (q_b, α_b). SE starts at $(0, 0)$ and increases as q_b increases from 0 to q_b^*, where q_b^* solves $u'(q_b^*) = c'(q_{q_b}^*)$. Then, SE decreases to $\alpha_b = 0$ when $q_b = \hat{q}_b$, where $\hat{q}_b > 0$ solves $u(\hat{q}_b) = c(\hat{q}_b)$. BS goes through $(0, \tilde{\alpha}_b)$, where $\tilde{\alpha}_b > 0$ as long as $u(\bar{q}) > 0$. BS also increases with low values of q_b and decreases with high values of q_b to $\alpha_b = 0$. The equilibrium is given by the intersection between both curves. It is well known that models with indivisible assets can generate equilibria with $q_i > q_i^*$ where $i \in \{b, m\}$. As it can be proven that allowing lotteries (Berentsen et al., 2002) rules out such a result, I restrict my attention to equilibria with $q_i \leq q_i^*$. Notice from the FOC that α_b decreases with δ iff the surplus $u(q_b) - q_b$ decreases with δ. As shown in Figure (5.5a), as δ increases the BS curve rotates down, and q_b and α_b are reduced. In the new equilibrium, less q_b



(a) Coca-base

(b) Fiat Money

Figure 5.5: Search intensity

is produced for a unit of coca-base, i.e. the expected surplus from trade with coca-base diminishes and thus agents invest less in searching for a trading partner. The result of a more aggressive coca-base seizure policy is that coca-base holders reduce the intensity of their search.

Figure (5.5b) shows the effect of the same policy on the equilibrium (q_m, α_m). SE curve has the same properties described above. In contrast, BS now does not start at $(0, 0)$ as long as $q_b > 0$. Additionally, the BS curve appears to be a loop. For an intermediate α_m there are two solutions q_m, and for high and low α_m there are none. A more aggressive coca-base seizure policy lowers q_b, thus contracting the BS curve. There are two equilibria and the effect of policy on (q_m, α_m) will depend on if the economy is in the low (q_m^L, α_m^L) or high (q_m^H, α_m^H) equilibrium. Since in the high equilibrium q_m^H decreases, the expected surplus from trade with fiat money lowers. Fiat money holders invest less in search and α_m^H reduces. The opposite happens in the low equilibrium where agents increase their search effort α_m^L.

5.4 Coca-base production intensity

This section examines the effect of coca-base seizures on the coca-base production intensity. To this end, I let producers choose the optimal amount of effort λ to meet a coca-leaf crop. The disutility cost of such effort is $\mu(\lambda)$, where $\mu(0) = \mu'(0) = 0$, $\mu'(\lambda) > 0$, and $\mu''(\lambda_i) > 0$ for $\lambda > 0$. While searching for illicit crops, producers can still meet with asset holders and produce for them. Assuming $\delta \geq \delta^*$, the value functions are

$$rV_p = \max_{\lambda \geq 0} \{\alpha A_b x(V_b - V_p - q_b) + \alpha A_m x(V_m - V_p - q_m) + \lambda(V_b - V_p) - \mu(\lambda)\} \tag{30}$$

$$rV_b = \alpha(1 - A)x[u(q_b) + V_p - V_b] + \delta(V_p - V_b) + \phi[u(\bar{q}) + V_p - V_b] \tag{31}$$

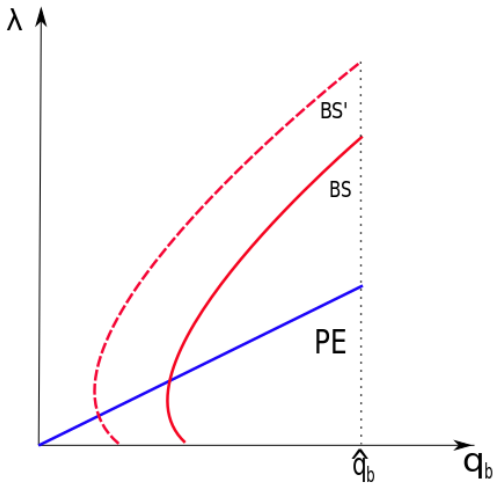


Figure 5.6: Coca-base production intensity

$$rV_m = \alpha(1-A)x[u(q_m) + V_p - V_m]. \tag{32}$$

Since buyers make take-it-or-leave-it offers, and assuming $\alpha x = 1$ with no loss of generality, an equilibrium for the optimal effort for producing coca-base is a pair (λ, q_b) that solves

$$\mu'(\lambda) = q_b \tag{33}$$

$$q_b = \frac{(1-A)[u(q_b)] + \phi u(\bar{q}) + \mu(\lambda)}{r + (1-A) + \delta + \phi + \lambda}. \tag{34}$$

Equations (33) and (34) define a production effort (PE) curve and a BS curve, both in (q_b, λ) space. As shown in Figure (5.6), PE starts at $(0, 0)$ and increases as q_b increases from 0 to $\hat{q}_b$. Instead, BS goes through $(\tilde{q}_b, 0)$ where $\tilde{q}_b > 0$ as long as $u(\bar{q}) > 0$. For low values of λ, BS is downward-sloping, while for high values of λ BS is upward-sloping. A higher probability of seizure δ shifts BS to the left, reducing q_b. From the FOC in (33), when the marginal benefit of production intensity reduces, agents decide to invest less in searching for a coca-leaf crop. Thus, in the new equilibrium, q_b and λ are lowered.

Once the equilibrium (λ, q_b) is determined, we can find the value of fiat money

$$q_m = \frac{(1-A)[u(q_m)] + \mu(\lambda) - \lambda q_b}{r + (1-A) + \lambda}. \tag{35}$$

If $\mu(\lambda) - \lambda q_b < 0 \equiv \nu$ there is an equilibrium where fiat money is not accepted as a means of payment, and there could be one or two monetary equilibria depending on the size of ν regarding $(1-A)[u(q_m)]$ as shown for the case studied in Figure (5.2).

5.5 Stock of coca-base

The aim now is to study the effect of coca-base seizures on the stock of coca-base produced by the economy. Following Choi and Rocheteau (2019), I modify the environment to let producers choose between two occupations: goods producer or coca-base producer. The economy has two zones, one for trading and the other for coca-base production. Those who decide to be coca-base producers give up their technology to produce consumption goods and enter with no cost the coca-base production zone. Agents who choose to be goods producers stay in the trading zone where they potentially meet agents with assets to trade. When a unit of coca-base has been produced, the agent leaves with no cost the coca production zone and re-enters the trading zone as a coca-base holder.

Define N_g, N_c, N_b, N_m as the measures of goods producers, coca-base producers, coca-base holders, and fiat money holders in the whole economy, where $N_g + N_c + N_m + N_b = 1$. Since the coca production and trading zones are mutually exclusive, it is convenient to redefine A_b and A_m as the fractions of agents in the trading zone holding coca-base and fiat money, where $A_b = \frac{N_b}{N_b+N_m+N_g}$ and $A_m = \frac{N_m}{N_b+N_m+N_g}$. Thus, $1 - A$ is the fraction of goods producers in the trading zone, where $A = A_b - A_m$. The others features of the environment remain unchanged.

5.5.1 Case 1: no fiat money

We start studying the case where $N_m = 0$ and $\delta \geq \delta^*$. Thus the value functions become

$$rV_p = \max\{\alpha A_b x(V_b - V_p - q_b), \lambda(V_b - V_p)\} \tag{36}$$

$$rV_b = \alpha(1 - A)x[u(q_b) + V_p - V_b] + \delta(V_p - V_b) + \phi[u(\bar{q}) + V_p - V_b]. \tag{37}$$

Equation (36) shows that producers choose among the two occupations. The first term corresponds to those who decide to become goods producers, while the second for those who become coca-base producers. The quantity q_b to be produced in a bilateral match is determined according to the Kalai (1977) bargaining solution. This solution specifies that the buyer obtains a constant fraction of the match surplus, thus

$$u(q_b) + V_p - V_b = \theta[u(q_b) - q_b], \tag{38}$$

where $\theta \in [0, 1]$ is the buyer's share. Solving for $V_b - V_p$ we obtain

$$V_b - V_p \equiv \gamma(q_b) = (1 - \theta)u(q_b) + \theta q_b. \tag{39}$$

Making use of (39), we can rewrite equations (36) and (37). They thus become

$$rV_p = \max\{\alpha A_b x(1 - \theta)[u(q_b) - q_b], \lambda\gamma(q_b)\} \tag{40}$$

$$rV_b = \alpha(1-A)x\theta[u(q_b) - q_b] - \delta\gamma(q_b) + \phi[u(\bar{q}) - \gamma(q_b)]. \tag{41}$$

The net instantaneous gain from being a coca-base producer instead of a goods producer is

$$\Delta(q_b) \equiv \lambda\gamma(q_b) - \alpha A_b x(1-\theta)[u(q_b) - q_b]. \tag{42}$$

Thus, the fraction of coca-base holders is given by

$$A_b = \begin{cases} 1, & \text{if } \Delta > 0 \\ \in [0,1], & \text{if } \Delta = 0 \\ 0, & \text{if } \Delta < 0. \end{cases} \tag{43}$$

If $\Delta = 0$, there is an interior solution for A_b which can be expressed as

$$A_b = \frac{\lambda\gamma(q_b)}{\alpha x(1-\theta)[u(q_b) - q_b]}. \tag{44}$$

Subtracting (40) from (41) and using (39), we get the value of coca-base in the trading zone

$$\gamma_b = \frac{\alpha x[u(q_b) - q_b](\theta - A_b) + \phi u(\bar{q})}{r + \delta + \phi}. \tag{45}$$

Substituting $\gamma(q_b)$ by its expression given in (39), rearranging and assuming $\alpha x = 1$ with no loss of generality

$$q_b = \frac{u(q_b)[(\theta - A_b) - (1-\theta)z] + \phi u(\bar{q})}{\theta(1+z) - A_b}, \tag{46}$$

where $z \equiv r + \delta + \phi$. Inserting (45) into (44), A_b can be re-expressed as

$$A_b = \frac{\lambda\{\theta[u(q_b) - q_b] + \phi u(\bar{q})\}}{[u(q_b) - q_b]\{z(1-\theta) + \lambda\}}. \tag{47}$$

Equation (46) defines a BS curve, while equation (47) defines a coca-base holders (CH) curve. An equilibrium is pair (q_b, A_b) solving (46) and (47). Restricting attention to the relevant region of (q_b, A_b) space, $(0, \hat{q}_b) \times [0,1]$, Figure (5.7) shows that CH is downward (upward)-sloping to the left (right) of q_b^*, while BS is downward-sloping. By inspection of equations (46) and (47) it can be noted that a change in δ directly affects both BS and CH. As a result, when the probability of seizure increases, BS shifts to the left and CH shifts down. In reducing q_b, a stronger coca-base seizure policy lowers the gain from being a coca-base producer, and thus A_b must fall to maintain $\Delta = 0$. In the new equilibrium, there is a reduced exchange value of coca-base and a smaller fraction of agents who want to hold it. Recalling that each agent can only hold one unit of assets, the reduced fraction of coca-base holders implies that the stock of coca-base produced by the economy is lowered.

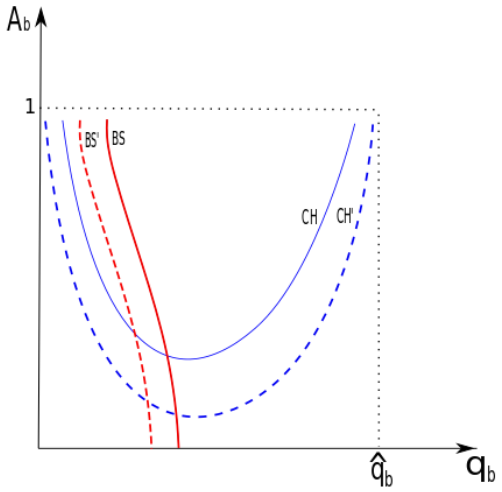


Figure 5.7: Stock of coca-base and exchange value

5.5.2 Case 2: fiat money

Now a fraction $N_m \in (0,1)$ is endowed with fiat money and thus $A_m > 0$. In addition to (37), I rewrite the value function for producers and introduce the value function for fiat money holders

$$rV_p = \max\{\alpha A_b x(V_b - V_p - q_b) + \alpha A_m x(V_m - V_p - q_m), \lambda(V_b - V_p)\} \tag{48}$$

$$rV_m = \alpha(1-A)x[u(q_m) + V_p - V_m] \tag{49}$$

Following the same procedure as above, we find the system of equations that determine the equilibrium,

$$q_b = \frac{u(q_b)[\theta(1-A_m) - A_b - (1-\theta)z] - A_m(1-\theta)[u(q_m) - q_m] + \phi u(\bar{q})}{\theta(1-A_m+z) - A_b} \tag{50}$$

$$q_m = \frac{u(q_m)[\theta(1-A_b) - A_m - (1-\theta)r] - A_b(1-\theta)[u(q_b) - q_b]}{\theta(1-A_b+r) - A_m} \tag{51}$$

$$A_b = \frac{\lambda\{\theta(1-A_m)[u(q_b) - q_b] - A_m(1-\theta)[u(q_m) - q_m] + \phi u(\bar{q})\}}{[u(q_b) - q_b]\{z(1-\theta) + \lambda\}}. \tag{52}$$

An equilibrium is a triple (q_b, q_m, A_b) solving (50), (51), (52). In all the examples checked coca-base and fiat money always circulate as means of payment, and so a positive fraction of population holds coca-base. However, since there is multiplicity of equilibria it becomes hard to unambiguously characterize the effect of coca-base

seizures on the exchange values and the fraction of coca-base holders. After an increase of δ, the exchange values q_m and q_b and the fraction A_b can either increase or decrease.

The results of section (5.4) and (5.5.1) are in line with the evidence that interdiction strategies are effective at curbing the cocaine supply (Mejía, 2015). However, the chapter explores a new mechanism through which such an effect occurs. In increasing the probability of suffering a seizure, the exchange value of coca-base in trade reduces which has two effects on the production behavior. On the one hand, agents invest less in searching for coca-leaf crops. On the other hand, the benefits from being a coca-base producer decline and the stock of coca-base produced by the economy is reduced.

5.6 Conclusion

In coca-growing regions of Colombia, coca-base is widely used as a means of payment. This chapter built a theoretical search model to investigate the potential effects of coca-base seizures on the exchange value of coca-base. If the probability of suffering a seizure is sufficiently low, coca-base holders will not trade with intermediaries and retain the coca-base for future trade with producers. In equilibrium, coca-base will always be accepted in trade but is only valued by the liquidity services it renders. In contrast, if the probability of suffering a seizure is sufficiently high, coca-base holders will always trade with intermediaries. In such a case, coca-base is also valued as an input for final cocaine. As long as the exchange value contains a component of positive discounted intrinsic value, coca-base, in equilibrium, will always be accepted in trade. An increased probability of suffering a seizure decreases the exchange value of coca-base, regardless of whether trade with intermediaries takes place or not. However, only an extremely strong policy of coca-base seizures that makes the discounted intrinsic value to converge to zero could drive coca-base out of circulation. Furthermore, an increased probability of suffering a seizure lowers the efforts agents put to both meet a trading partner and produce a unit of coca-base, as well as it lowers the stock of coca-base produced by the economy. The results regarding the drop in the production of coca-base are consistent with the evidence about the ability of the anti-narcotics policy to curb the cocaine supply. The novelty of the chapter, however, is that it proposes a different mechanism through which the anti-narcotic policy can affect the production of coca-base: the reduction of the exchange value of coca-base.

General Conclusion

This thesis lies at the intersection of philosophy and monetary economics, focusing on liquidity-based asset classification. Liquidity refers to a complex phenomenon with multiple dimensions. Currently, the uses of liquidity in economics and finance tend to fall in one of the following four senses: central bank liquidity, funding liquidity, market liquidity, and exchange liquidity. In the thesis, liquidity is understood as exchange liquidity. For monetary economists, such a notion of liquidity refers to the degree which assets are directly useful in facilitating transactions.

Monetary economists have resorted to the notion of exchange liquidity to explain the value of fiat money such as a dollar bill. In many trades people readily accept a dollar bill as payment for a good or service, thus the puzzle is that a dollar bill is an asset with a positive value in trade, but whose fundamental value is nil. The answer monetary economists provide to this puzzle is that without a means of payment people could not carry out many mutually beneficial exchanges. A dollar bill is thus positively valued because it facilitates exchange. However, assets can facilitate exchange in more than one way. One is certainly by being used as a means of payment; another, by serving as collateral. Either as a means of payment or as a collateral, assets are providing what monetary economists technically call liquidity services.

Liquidity is a property that opens the possibility to devise a taxonomy of assets. Perhaps the most popular asset classification is the one that distinguishes between 'money' and 'non-money.' However, there are other ways to classify assets based on liquidity. We could say that any asset that provides liquidity services either as a means of payments and/or as collateral will belong to a category that we decide to name 'liquid assets.' Thus, for instance, both a dollar bill that is widely used as a means of payment and a Treasury bond that is widely accepted as collateral will belong to 'liquid assets.'

The thesis addresses two main questions about the validity and extension of liquidity-based asset classification. A first question is: Does liquidity-based asset classification pick out a natural kind? Using the category 'liquid assets,' the thesis shows that liquidity is a functional property that can be realized in two genuinely different ways. Assets can render liquidity services through either monetary trades or credit trades. Regardless of whether they are traded via monetary or credit trades, assets belonging to the kind 'liquid assets' have a common property: they are also valued by their liquidity services, therefore their prices can depart from the fundamental value. The thesis thus argues that 'liquid assets' can be regarded as a functional kind with multiple realizations.

Furthermore, liquidity is a property influenced by social and institutional practices in which the human mind inevitably intervenes. However, such a mind-dependence does not necessarily prevent liquidity-based asset classification from having causal powers and inductive and explanatory potential. The case of 'liquid assets' illustrates that liquidity-based asset classification can play an epistemic role in explanatory models. Because of its ability to ground inductive inference and explanation, the category 'liquid assets' designates a natural kind according to the functionalist approach.

The second question is the following: Is there a sharp boundary between categories of assets that are classified based on their liquidity? A more restrictive category than 'liquid assets' is 'money.' 'Money' includes all assets that have achieved a certain threshold of liquidity by serving as a means of payment either via monetary or credit trades. Thus, unlike 'liquid assets,' the category 'money' excludes assets serving as collateral. The thesis argues against the view that there is a discrete break between the categories of 'money' and 'non-money.' Such a view can be successful only, if following traditional essentialism, there is a set of intrinsic properties that are necessary and sufficient for membership in the natural kind designated by the term 'money.' However, based on what is currently known by monetary economists, there is neither set of intrinsic properties nor necessary and sufficient characteristics that one could use to separate 'money' unambiguously from 'non-money.' Thus, there is nothing in the nature of money that can be interpreted as a natural kind essence.

The multiple objects that are accepted in trade differ in their degree of liquidity and such a difference does not become a difference in kind. Therefore, the boundaries of a given category of assets are rather decided than found in nature. Economists draw the dividing line among assets in a point that is convenient for a given purpose: testing a hypothesis, building a simplified model, predicting a phenomenon, designing a policy, or regulating an activity. Instead of being a question about the ontology of kinds, the extension of liquidity-based categories is a question in epistemology.

A limitation of the thesis is that it does not address how economists' epistemic interests play a part in deciding the extension of kinds, including multiply realized kinds. This is a topic that I will explore in future research. I am interested in investigating the history of monetary aggregates and the reasons driving divides such as M0, M1, and M2. Likewise, it would be interesting to study salient episodes in which, when testing a certain generalization (e.g., the neutrality of money), monetary economists had to decide the extension of a category like 'money.'

Once the questions regarding liquidity-based asset classification has been addressed the thesis directly engages in the study of liquidity. The thesis contributes to the theoretical study of illegal means of payment with the same models developed by monetary economists. In coca-growing regions of Colombia, coca-base is widely used as a means of payment. The thesis builds a theoretical search model in which both coca-base and official currency circulate as means of payment. The model shows that an increased probability of suffering a seizure lowers the exchange value of coca-base, which also leads to a reduction of the search intensity, the production intensity, and the stock of coca-base produced by the economy. While the fall in the production of inputs for cocaine is a result already pointed out by the literature on drug-trafficking, the novelty of this model is that it proposes a different mechanism through which the anti-narcotics policy can affect the production of coca-base: the exchange value of coca-base in internal trade.

Bibliography

A. Alexandrova and R. Northcott. It's just a feeling: why economic models do not explain. *Journal of Economic Methodology*, 20(3):262–268, 2013.

A. Alvarez and V. Bignon. L. Walras and C. Menger: Two ways on the path of modern monetary theory. *The European Journal of the History of Economic Thought*, 20(1):89–124, 2013.

Y. Amihud, H. Mendelson, L. H. Pedersen, et al. Liquidity and asset prices. *Foundations and Trends® in Finance*, 1(4):269–364, 2006.

D. Andolfatto. Is bitcoin a safe asset? [blog] macromania. 2016. URL `http://andolfatto.blogspot.com/2016/03/is-bitcoin-safe-asset.html`.

D. Andolfatto and F. Martin. Information disclosure and exchange media. *Review of Economic Dynamics*, 16:527–539, 2013.

G. E. M. Anscombe. On brute facts. *Analysis*, 18(3):69–72, 1958.

L. Araujo. Social norms and money. *Journal of Monetary Economics*, 51:241–256, 2004.

R. Arena and S. Gloria-Palermo. Menger and Walras on money: A comparative view. *History of Political Economy*, 40(2):317–343, 2008.

A. Banerjee and E. Maskin. A walrasian theory of money and barter. *The Quarterly Journal of Economics, CXI*, pages 955–1005, 1996.

W. A. Barnett. Economic monetary aggregates: An application of aggregation and index number theory. *Journal of Econometrics*, 14:11–48, 1980.

W. A. Barnett. The optimal level of monetary aggregation. *Journal of Money, Credit, and Banking*, 14:687–710, 1982.

D. G. Baur, K. Hong, and A. D. Lee. Bitcoin: Medium of exchange or speculative assets? *Journal of International Financial Markets, Institutions and Money*, 54:177–189, 2018.

G. Becker and W. Baumol. The classical monetary theory: The outcome of the discussion. *Economica*, 19(76):355–376, 1952.

M. Beggs. Liquidity's second career. pages 1–32, 2015.

S. Bell. The role of the state and the hierarchy of money. *Cambridge Journal of Economics*, 25(2):149–163, 2001.

C. Benetti. The ambiguity of the notion of general equilibrium with a zero-price for money. In *Money in Motion*, pages 366–376. MacMillan Press, London, 1996.

C. Benetti. Money and prices: the limits of the general equilibrium theory. In F. Ackerman and A. Nadal, editors, *The Flawed Foundations of General Equilibrium. Critical essays on economic theory*, pages 48–67. Routledge, New York, 2004.

A. Berentsen and F. Schar. A short introduction to the world of cryptocurrencies. *Federal Reserve Bank of Louis Review, First Quarter*, 100(1):1–16, 2018.

A. Berentsen, M. Molico, and R. Wright. Indivisibilities, lotteries, and monetary exchange. *Journal of Economic Theory*, 107(1):70–94, 2002.

A. Berg-Sørensen, N. Holtug, and K. Lippert-Rasmussen. Essentialism vs. constructivism: Introduction. *Distinktion: Scandinavian Journal of Social Theory*, 11(1): 39–45, 2010.

V. Bignon and R. Dutu. Coin assaying and commodity money. *Macroeconomic Dynamics*, 21(6):1305–1335, 2017.

A. Bird and E. Tobin. Natural kinds. In E. N. Zalta, editor, *The Stanford Encyclopedia of Philosophy*. Metaphysics Research Lab, Stanford University, spring 2018 edition, 2018.

D. Booth. *Empirical Evidence and the Multiple Realization of Mental Kinds*. Electronic Thesis and Dissertation Repository, 5428. The University of Western Ontario, 2018.

R. Boyd. Constructivism, realism, and philosophical method. In J. Earman, editor, *Inference, explanation and other frustrations*, pages 131–198. University of California Press, Berkeley, USA, 1992.

R. Boyd. Homeostasis, species, and higher taxa. In and R. A, editor, *Wilson*, pages 145–185. New Interdisciplinary Essays . MIT press, Species, 1999.

P. Bridel. *Money and General Equilibrium Theory*. Elgar, Cheltenham, 1997.

P. Bridel. Patinkin, Walras and the 'money-in-the-utility-function' tradition. *The European Journal of the History of Economic Thought*, 9(2):268–292, 2002.

P. Bridel. Why is there money? Or yet a new attempt at solving the hahn problem. *OEconomia*, 4:623–635, 2014.

I. Brigandt. Natural kinds and concepts: A pragmatist and methodologically naturalistic account. *In: J. Knowles and H. Rydenfelt, edits*, pages 171–196, 2011.

K. Brunner. Inconsistency and indeterminacy in classical economics. *Econometrica*, 19 (2):152–173, 1951.

M. K. Brunnermeier. Bubbles, liquidity, and the macroeconomy. *NBER Reporter Online*, (2):10–12, 2010.

M. K. Brunnermeier and L. H. Pedersen. Market liquidity and funding liquidity. *The review of financial studies*, 22(6):2201–2238, 2009.

Z. Brzović. Natural kinds. *Internet Encyclopedia of Philosophy*, 2019.

C. Buckner. Functional kinds: a skeptical look. *Synthese*, 192:3915–3942, 2015.

K. Burdett, A. Trejos, and R. Wright. Cigarette money. *Journal of Economic Theory*, 99 (1-2):117–142, 2001.

S. Burgess and N. Janssen. Proposals to modify the measurement of broad money in the united kingdom: a user consultation. *Quarterly Bulletin*, pages 402–414, 2007.

A. Carstens. Money in the digital age: what role for central banks? *BIS Speech :*, 1, 2018.

J. Cartelier. Théorie de la valeur ou hétérodoxie monétaire: les termes d'un choix. *Economie appliquée*, 1:63–82, 1985.

J. Cartelier. Monnaie et marché. Un point de vue critique sur les modèles de prospection. *Revue Economique*, 52(5):993–1011, 2001.

J. Cartelier. *Money, markets and capital: The case for a monetary analysis*. Routledge, 2018.

N. Cartwright. If no capacities then no credible worlds but can models reveal capacities? *Erkenntnis*, 70(1):45–58, 2009.

S. G. Cecchetti, P. Disyatat, et al. *Central bank tools and liquidity shortages*. Federal Reserve Bank of New York, 2010.

CGTN. Priceless cash: Venezuelan artists turn 'worthless' money into art, 2018. URL `https://www.youtube.com/watch?v=3JOGCO9WQ_g`.

M. Choi and G. Rocheteau. Money mining and price dynamics. *Available at SSRN 3336367*, 2019.

R. Clower. A reconsideration of the microfundations of monetary theory. *Economic Inquiry*, 6(1):1–8, 1967.

R. Committee. Report of the radcliffe committee on the working of the monetary system. *London: Her Majesty's Stationery Office, Cmd.*, 827, 1959.

A. Cot and J. Lallement. 1859-1959 : de Walras à Debreu, un siècle d'équilibre général. *Revue économique*, 57:377–388, 2006.

A. Cramp. Two views on money. *Lloyds Bank Review*, 65:1–15, 1962.

C. F. Craver. Mechanisms and natural kinds. *Philosophical Psychology*, 22(5):575–594, 2009.

A. Crockett. Market liquidity and financial stability. *Financial Stability Review*, 11:13–17, 2008.

J. Culham. Revisiting the concept of liquidity in liquidity preference. *Cambridge Journal of Economics*, forthcoming, 2019.

E. S. Curtis and C. J. Waller. A search-theoretic model of legal and illegal currency. *Journal of Monetary Economics*, 45(1):155–184, 2000.

B. de Bruin, L. Herzog, M. O'Neill, and J. Sandberg. Philosophy of money and finance. In E. N. Zalta, editor, *The Stanford Encyclopedia of Philosophy*. Metaphysics Research Lab, Stanford University, winter 2018 edition, 2018.

M. Devitt. Scientific realism. *Truth and realism*, pages 100–124, 2006.

M. Doepke and M. Schneider. Money as a unit of account. *Econometrica*, 85(5):1537–1574, 2017.

J. Duffy. Learning to speculate: Experiments with artificial and real agents. *Journal of Economic Dynamics and Control*, 25(3-4):295–319, 2001.

J. Duffy and J. Ochs. Emergence of money as a medium of exchange: An experimental study. *American Economic Review*, 89(4):847–877, 1999.

J. Duffy and J. Ochs. Intrinsically worthless objects as media of exchange: Experimental evidence. *International Economic Review*, 43(3):637–673, 2002.

J. Dupré. *The disorder of things: Metaphysical foundations of the disunity of science*. Harvard University Press, 1993.

R. Dutu, E. Nosal, and G. Rocheteau. The tale of gresham's law. *Economic Commentary*, pages 1–4, 2005.

B. Ellis. *The Philosophy of Nature. A Guide to the New Essentialism*. 2002/2014.

J. Elster. *Explaining technical change: A case study in the philosophy of science*. CUP Archive, 1983.

B. Epstein. *The ant trap: Rebuilding the foundations of the social sciences*. Oxford University Press, USA, 2015.

B. Epstein. Précis of the ant trap. *Journal of Social Ontology*, 2(1):125–134, 2016.

M. Ereshefsky. Species. In E. N. Zalta, editor, *The Stanford Encyclopedia of Philosophy*. Metaphysics Research Lab, Stanford University, fall 2017 edition, 2017.

M. Ereshefsky and T. Reydon. Scientific kinds. *Philosophical Studies An International Journal for Philosophy in the Analytic Tradition*, 172(4):969–986, 2015.

N. Espinosa. *Política de vida y muerte: etnografía de la violencia diaria en la Sierra de la Macarena*. Instituto Colombiano de Antropología e Historia Bogotá, 2010.

A. Evans-Pritchard. *Support for euro in doubt as Germans reject Latin bloc notes. [online] The Telegraph*. The Telegraph, 2008.

D. Fields. Classical dichotomy. In L.-P. Rochon and S. Rossi, editors, *The Encyclopedia of Central Banking*, pages 94–95. Edward Elgar Publishing, London, 2015.

J. Fodor. Special sciences (or: The disunity of science as a working hypothesis). *Synthese*, 28(2):97–115, 1974.

J. Fodor. Special sciences: Still autonomous after all these years. *Philosophical perspectives*, 11:149–163, 1997.

D. Foley. Money in economic activity. In *Money*, pages 248–262. Springer, 1989.

J. Fox. What's the value of bitcoin? who knows. *Bloomberg*, 10:2018, 2017. URL `https://www.bloomberg.com/view/articles/2017-12-11/what-s-the-value-of-bitcoin-who-knows`.

C. Frasser and G. Guzmán. What do we call money? an appraisal of the money or non-money view. *Journal of Institutional Economics*, 16(1):25–40, 2020.

M. Friedman, editor. *Studies in the quantity theory of money*, volume 561. University of Chicago Press, 1956.

M. Friedman and A. J. Schwartz. *Monetary Statistics of the United States: Estimates, Sources, Methods*. NBER, Chicago, 1970.

I. M. Fund. *Monetary and Financial Statistics Manual and Compilation Guide*. International Monetary Fund, Washington, D.C., 2016.

D. Gale. Money and general equilibrium. In S. Durlauf and L. Blume, editors, *The New Palgrave Dictionary of Economics*, pages 1–8. Palgrave Macmillan, 2008.

A. Geromichalos, J. Licari, and J. Suárez-Lledó. Monetary policy and asset prices. *Review of Economic Dynamics*, 10:761–779, 2007.

A. Geromichalos, K. M. Jung, S. Lee, and C. Dillon. Asset liquidity in monetary theory and finance: A unified approach. Technical report, Working Paper, 1-48, 2019.

D. Goldberg. The tax-foundation theory of fiat money. *Economic Theory*, 50(2):489–497, 2012.

C. Goodhart. The two concepts of money: implications for the analysis of optimal currency areas. *European Journal of Political Economy*, 14(3):407–432, 1998.

D. Graeber. *Debt: the first 5000 years*. Melville House, New York, 2011.

L. Gramley and S. Chase. Time deposits in monetary analysis. *Federal Reserve Bulletin*, 51:1380–1404, 1965.

J. M. Grandmont. On the short-run equilibrium in a monetary economy. In J. Dreze, editor, *Allocation under Uncertainty: Equilibrium and Optionality*. John Wiley and Sons, New York, 1974.

T. Grüne-Yanoff. Appraising non-representational models. *Philosophy of Science*, 80(5): 850–861, 2013.

F. Guala. Infallibilism and human kinds. *Philosophy of the Social Sciences*, 40:244–264, 2010.

F. Guala. Philosophy of the social sciences: Naturalism and anti-naturalism in the philosophy of social science. In P. Humphreys, editor, *The Oxford Handbook of Philosophy of Science*. Oxford, New York, 2016a.

F. Guala. *Understanding Institutions. The Science and Philosophy of Living Together*. Princeton University Press, New Jersey, 2016b.

F. Guala. Epstein on anchors and grounds. *Journal of Social Ontology*, 2(1):135–147, 2016c.

F. Guala and F. Hindriks. A unified social ontology. *The philosophical quarterly*, 65(259): 177–201, 2015.

G. Guzmán and C. Frasser. Rules, incentivization, and the ontology of human society. *Philosophy of the Social Sciences*, 47(6):440–462, 2017.

I. Hacking. A tradition of natural kinds. *Philosophical Studies: An International Journal for Philosophy in the Analytic Tradition*, 61:109–126, 1991.

F. Hahn. On some problems of proving the existence of an equilibrium in a monetary economy. In Hahn and F. Brechling, editors, *The Theory of Interest Rates*. Macmillan, London, 1965.

F. Hahn. On the foundations of monetary theory. In M. Parkin, editor, *Essays in modern economics*, pages 230–242. Longman, UK, 1973.

F. Hahn. *Money and Inflation*. MIT Press, Cambridge Mass, 1983.

M. Haug. Natural properties and the special sciences: Nonreductive physicalism without levels of reality or multiple realizability. *The Monist*, 94(2):244–266, 2011.

D. Hausman. *The inexact and separate science of economics*. Cambridge University Press, Cambridge, Great Britain, 1992.

K. Hawley and A. Bird. What are natural kinds? *Philosophical Perspectives*, 25:205–221, 2011.

F. Hayek. *Denationalisation of Money-The Argument Refined. An Analysis of the Theory and Practice of Concurrent Currencies*. s.n, London, 1976/1990.

M. Hayes. The liquidity of money. *Cambridge Journal of Economics*, 42(5):1205–1218, 2018.

P. K. Hazlett and W. J. Luther. Is bitcoin money? and what that means. *The Quarterly Review of Economics and Finance*, 2019.

M. Hellwig. The challenge of monetary theory. *European Economic Review*, 37:215–242, 1993.

J. R. Hendrickson. Redundancy or mismeasurement? a reappraisal of money. *Macroeconomic Dynamics*, 18(7):1437–1465, 2014.

O. Hernández. Money art, 2018. URL `https://cnnespanol.cnn.com/video/inventiva-ante-la-adversidad-en-venezuela`.

J. Hicks. A suggestion for simplifying the theory of money. *Economica*, 2(5):1–19, 1935.

J. R. Hicks. Liquidity. *The Economic Journal*, 72(288):787–802, 1962.

F. Hindriks. Constitutive rules, language, and ontology. *Erkenntnis*, 71(2):253–275, 2009.

F. Hindriks. Explanation, understanding, and unrealistic models. *Studies in History and Philosophy of Science*, 44:523–531, 2013.

F. Hindriks and F. Guala. The functions of institutions: etiology and teleology. *Synthese*, pages 1–17, 2019.

K. Hoover. Some suggestions for complicating the theory of money. In *En: S*, pages 204–216. Routledge, Interactions in political economy. Malvern After Ten Years. London, 1996.

T. Hu and G. Rocheteau. Monetary policy and asset prices: A mechanism design approach. *Journal of Money, Credit and Banking*, 47:39–76, 2015.

G. Ingham. Money is a social relation. *Review of Social Economy*, 15(4), 1996.

G. Ingham. The nature of money. *Economic Sociology: European Electronic Newsletter*, 5 (2):18–28, 2004.

K. Iwai. The bootstrap theory of money: A search-theoretic foundation of monetary economics. *Structural Change and Economic Dynamics*, 7(4):451–477, 1996.

O. Jansson. Tríadas putumayenses: relaciones patrón-cliente en la economía de la cocaína. *Revista Colombiana de Antropología*, 42:223–247, 2006.

C. Jenkins. Realism and independence. *American Philosophical Quarterly*, 42(3):199–209, 2005.

H. Jensen. *Monetary Economics: Macro Aspects*. University of Copenhagen, 2015.

K. Jung and J. Pyun. International reserves for emerging economies: A liquidity approach. *Journal of International Money and Finance*, 68:230–257, 2016.

E. Kalai. Proportional solutions to bargaining situations: interpersonal utility comparisons. *Econometrica: Journal of the Econometric Society*, pages 1623–1630, 1977.

J. M. Keynes. *The General Theory of Employment, Interest, and Money*. Macmillan, London, 1936/1949.

M. A. Khalidi. *Natural Categories and Human Kinds. Classification in the Natural and Social Sciences*. Cambridge University Press, New York, USA, 2013.

M. A. Khalidi. Mind-dependent kinds. *Journal of Social Ontology*, 2(2):223–246, 2016.

O. Kharif. Bitcoin's use in commerce keeps falling even as volatility eases. *Bloomberg*, 10, August 2018. URL `https://www.bloomberg.com/news/articles/2018-08-01/bitcoin-s-use-in-commerce-keeps-falling-even-as-volatility-eases`.

H. Kincaid. The empirical presuppositions of metaphysical explanations in economics. *The Monist*, 78(3):368–385, 1995.

N. Kiyotaki and J. Moore. Liquidity, business cycles, and monetary policy. *Manuscript of Clarendon Lecture*, 2, 2001.

N. Kiyotaki and J. Moore. Liquidity, business cycles, and monetary policy. In *Journal of Political Economy*. 127(6), Electronically published, 2019.

N. Kiyotaki and R. Wright. On money as a medium of exchange. *Journal of Political Economy*, 97(4):927–954, 1989.

N. Kiyotaki and R. Wright. A contribution to the pure theory of money. *Journal of Economic Theory*, 53:215–235, 1991.

N. Kiyotaki and R. Wright. Acceptability, means of payment, and media of exchange. *Quarterly Review. Federal Reserve Bank of Minneapolis*, 16(3):18–21, 1992.

N. Kiyotaki, R. Lagos, and R. Wright. Introduction to the symposium issue on money and liquidity. *Journal ofEconomicTheory*, 164:1–9, 2016.

G. Knapp. *The State Theory of Money*. London: Macmillan and Company Limited, 1924.

N. Kocherlakota. Money is memory. *Journal of Economic Theory*, 81(2):232–251, 1998.

M. Kohn. In defense of the finance constraint. *Economic Inquiry*, 19:177–195, 1981.

J. Koning. Best buddies: Keynes and hayek on moneyness. [blog] moneyness. 10: Accessed 2018, July 2013. URL http://jpkoning.blogspot.com/2013/01/best-buddies-keynes-hayek-on-moneyness.html.

J. Koning. Playing bitcoin: Remember, it's just a game. 2018. URL https://breakermag.com/play-bitcoin-remember-its-just-a-game/.

K. Koslicki. Natural kinds and natural kind terms. *Philosophy compass*, 3(4):789–802, 2008.

A. Krishnamurthy and A. Vissing-Jorgensen. The aggregate demand for treasury debt. *Journal of Political Economy*, 120(2):233–267, 2012.

A. Kukla. *Social Constructivism and the Philosophy of Science*. Routledge, London, 2000.

J. Ladyman and D. Ross. *Every Thing Must Go: Metaphysics Naturalized*. New York, 2007.

R. Lagos. *On Liquidity and the Search Theory of Money*. Economic Dynamics Newsletter, Review of Economic Dynamics. Retrieved from Economic Dynamics, 2008. URL https://www.economicdynamics.org/newsletter-nov-2008/#8e74e7178ec1f94c8.

R. Lagos. Asset prices and liquidity in an exchange economy. *Journal of Monetary Economics*, 57:913–930, 2010.

R. Lagos and G. Rocheteau. Inflation, output, and welfare. *International Economic Review*, 46(2):495–522, 2005.

R. Lagos and R. Wright. A unified framework for monetary theory and policy analysis. *Journal of Political Economy*, 113(3):463–484, 2005.

R. Lagos and R. Wright. When is money essential? Technical report, A Comment on Aliprantis, Camera, and Puzzello. Mimeo, 1-8, 2008.

R. Lagos, G. Rocheteau, and R. Wright. Liquidity: A new monetarist perspective. *Journal of Economic Literature*, 55(2):371–440, 2017.

J. Lallement. Le modèle déductif-nomologique et l'explication en économie. In A and P. Livet, editors, *L*, pages 181–210. Economica, Leçons de philosophie économique . Paris, 2007.

S. Lee. Money, asset prices, and the liquidity premium. *Journal of Money, Credit and Banking*, 2019. Forthcoming.

S. Lee and K. Jung. A liquidity-based resolution of the uncovered interest parity puzzle. *Journal of Money, Credit and Banking*, 2019. Forthcoming.

V. E. Li. The optimal taxation of fiat money in search equilibrium. *International Economic Review*, pages 927–942, 1995.

L. Q. Liu, L. Wang, and R. Wright. On the "hot potato" effect of inflation: Intensive versus extensive margins. *Macroeconomic Dynamics*, 15(S2):191–216, 2011.

L. Ljungqvist and T. Sargent. *Recursive Macroeconomic Theory (Third Edition ed.)*. The MIT Press, Cambridge, Massachusetts, 2012.

S. Lotz. Introducing a new currency: Government policy and prices. *European Economic Review*, 48:959–982, 2004.

S. Lotz and G. Rocheteau. On the launching of a new currency. *Journal of Money, Credit and Banking*, 34(3):563–588, 2002.

E. Lowe. A problem for a posteriori essentialism concerning natural kinds. *Analysis*, 67 (4):286–292, 2007.

R. Lucas. Equilibrium in a pure currency economy. *Economic Inquiry*, 18:203–220, 1980.

R. Lucas and N. Stokey. Optimal fiscal and monetary policy in an economy without capital. *Journal of Monetary Economics*, 12:55–93, 1983.

R. Lucas and N. Stokey. Money and interest in a cash-in-advance economy. *Econometrica*, 55:491–513, 1987.

R. E. Lucas Jr. Liquidity: meaning, measurement, management. *Federal Reserve Bank of St. Louis Review*, 96(Third Quarter 2014), 2014.

U. Mäki. Mengerian economics in realist perspective. In *B. Caldwell*, pages 289–312. Annual supplement to History of political economy, 22, 1990.

U. Mäki. On the method of isolation in economics. In . C. D. U. Mäki, editor, *Intelligibility in Science*, pages 319–354. Atlanta and Amsterdam: Rodopi, 1992.

U. Mäki. Reflections on the ontology of money. *Unpublished manuscript*, 2009.

U. Mäki. Scientific realism as a challenge to economics (and vice versa). *Journal of Economic Methodology*, 18(1):1–12, 2011.

U. Mäki. On a paradox of truth, or how not to obscure the issue of whether explanatory models can be true. *Journal of Economic Methodology*, 20(3):268–279, 2013.

C. Marchionni. What is the problem with model-based explanation in economics? *Disputatio, IX(*, 47:603–630, 2017.

D. Marshall and B. Weatherson. Intrinsic vs. extrinsic properties. In E. N. Zalta, editor, *The Stanford Encyclopedia of Philosophy*. Metaphysics Research Lab, Stanford University, spring 2018 edition, 2018.

A. Martinich. Reference, truth, and fiction. In B. Mou, editor, *Searle's Philosophy and Chinese Philosophy. Constructive Engagement*, pages 197–220. Koninklijke Brill NV, Leiden, The Netherlands, 2008.

A. P. Martinich. Fiction as an institution. *Comparative Philosophy*, 8(1):100–113, 2017.

K. Marx. *Capital. A critique of political economy.* Modern Library/Random House, New York, 1867/1906.

F. Mattesini. Modeling money and credit: The new monetarist view. *The Manchester School*, 87(1):29–44, 2019.

S. Medema and W. E. Samuels. *Foundations of research in economics: how do economists do economics?* Edward Elgar, Cheltenham, UK, 1996.

D. Mejía. Plan colombia: an analysis of effectiveness and costs. *Washington, DC: Brookings Institution*, 2015.

D. Mejía and D. M. Rico. *La microeconomía de la producción y tráfico de cocaína en Colombia*. Universidad de los Andes, Facultad de Economía, 2010.

C. Menger. On the origin of money. *The Economic Journal*, 2(6):239–255, 1892.

A. Miller. Realism. In E. N. Zalta, editor, *The Stanford Encyclopedia of Philosophy*. Metaphysics Research Lab, Stanford University, winter 2019 edition, 2019.

H. Minsky. *Stabilizing an Unstable Economy*. Yale University Press, New Haven(CT), 1986/2008.

F. S. Mishkin and S. G. Eakins. *Financial markets and institutions*. Pearson Education, Malaysia, 2006.

M. Morgan and M. E. Morrison. *Models as Mediators Perspectives on Natural and Social Science*. Cambridge University Press, Cambridge , UK, 1999.

S. Morris and H. S. Shin. Financial regulation in a system context. *Brookings papers on economic activity*, 2008(2):229–274, 2008.

S. Nagel. The liquidity premium of near-money assets. *The Quarterly Journal of Economics*, 131(4):1927–1971, 2016.

P. Needham. Microessentialism: What is the argument? *Noûs*, 45(1):1–21, 2011.

A. Nelson. Are economic kinds natural kinds? *Savage, Scientific Theories*, pages 102–36, 1990.

Y. Nersisyan and F. Dantas. Rethinking liquidity creation: Banks, shadow banks and the elasticity of finance. *Journal of Post Keynesian Economics*, 40(3):279–299, 2017.

W. T. Newlyn. The supply of money and its control. *Economic Journal*, 74(294):327–346, 1964.

K. Nikolaou. Liquidity (risk) concepts: definitions and interactions. (1008), 2009.

E. Nosal and G. Rocheteau. Pairwise trade, asset prices, and monetary policy. *Journal of Economic Dynamics and Control*, 37:1–17, 2013.

ODC. Observatorio de drogas de colombia, Nov 2019. URL `http://www.odc.gov.co/sidco`.

J. Ostroy. Money and general equilibrium theory. In M. M. J. Eatwell and P. Newman, editors, *The New Palgrave Dictionary of Economics*, pages 6736–6742. Palgrave Macmillan, 1987.

J. Ostroy and R. Starr. The transactions role of money. In B. Friedman and F. Hahn, editors, *Handbook of Monetary Economics (Vo. 1)*, pages 1–59. Elsevier Science Publishers, 1990.

D. Patinkin. The indeterminacy of absolute prices in classical economic theory. *Econometrica*, 17(1):1–27, 1949.

D. Patinkin. A reconsideration of the general equilibrium theory of money. *The Review of Economic Studies*, 18(1):42–61, 1950-1951.

D. Patinkin. The invalidity of classical monetary theory. *Ecometrica*, 19(2):134–151, 1951.

D. Patinkin. *Money, Interest, and Prices: An Integration of Monetary and Value Theory (2nd Edition ed.)*. Harper Row, New York, 1965.

B. Pesek and T. Saving. *Money, Wealth, and Economic Theory*. The Macmillan Company, New York, 1967.

P. Pettit. Functional explanation and virtual selection. *The British journal for the philosophy of science*, 47(2):291–302, 1996.

R. Plassard. Disequilibrium as the origin, originality, and challenges of Clower's microfoundations of monetary theory. *The European Journal of the History of Economic Thought*, 24(6):1388–1415, 2017.

T. W. Polger and L. A. Shapiro. *The multiple realization book*. Oxford University Press, 2016.

J. Rawls. Two concepts of rules. *The philosophical review*, 64(1):3–32, 1955.

A. Rebeyrol. *La pensée économique de Walras*. Dunod, Paris, 1999.

T. Reydon. How to fix kind membership: A problem for hpc-theory and a solution. *Philosophy of Science*, 76:724–736, 2009.

G. Rocheteau and E. Nosal. *Money, Payments, and Liquidity (2nd Edition ed.)*. The MIT Press, 2017.

G. Rocheteau and R. Wright. Liquidity and asset-market dynamics. *Journal of Monetary Economics*, 60:275–294, 2013.

C. Rogers. Money as friction: Conceptual dissonance in woodford's interest and prices. Technical report, Research Paper, 2008-03, 1-34, 2008.

A. Rosenberg. *Economics–Mathematical Politics or Science of Diminishing Returns?* University of Chicago Press, 1992.

P. Samuelson. An exact consumption-loan model of interest with or without the social contrivance of money. *Journal of Political Economy*, 66(6):467–482, 1958.

T. Sargent. Robert E. Lucas Jr.'s collected papers on monetary theory. *Journal of Economic Literature*, 53(1):43–64, 2015.

R. Sayers. Monetary thought and monetary policy in england. *The Economic Journal*, 70 (280):710–724, 1960.

J. Schumpeter. *History of Economics Analysis*. Oxford University Press, pp. 1-1260, New York, 1954.

J. Searle. *The Construction of Social Reality*. The Free Press, New York, 1995.

J. Searle. Reply to a. In M. I. B. Mou, editor, *P*, pages 221–227. Koninklijke Brill NV, Searle's Philosophy and Chinese Philosophy. Constructive Engagement . Leiden, The Netherlands, 2008.

J. Searle. *Making the Social World. The Structure of Human Civilization*. Oxford University Press, New York, USA, 2010.

G. Selgin. On ensuring the acceptability of a new fiat money. *Journal of Money, Credit and Banking*, 26(4):808–826, 1994.

G. Selgin. Synthetic commodity money. *Journal of Financial Stability*, 17:92–99, 2015.

A. Semenova. Would you barter with god? why holy debts and not profane markets created money. *The American Journal of Economics and Sociology*, 70(2):376–400, 2011.

L. Shapiro. Multiple realizations. *The Journal of Philosophy*, 97(12):635–654, 2000.

L. Shapiro. How to test for multiple realization. *Philosophy of Science*, 75:514–25, 2008.

S. Shi. Money and prices: A model of search and bargaining. *Journal of Economic Theory*, 67(2):467–496, 1995.

S. Shoemaker. *Physical realization*. Oxford University Press, 2007.

M. Sidrauski. Rational choice and patterns of growth in a monetary economy. *The American Economic Review*, 57(2):534–544, 1967.

J. Smit, F. Buekens, and S. Du Plessis. What is money?an alternative to searle's institutional facts. *Economics and Philosophy*, 27(1):1–22, 2011.

J. Smit, F. Buekens, and S. Du Plessis. Cigarettes, dollars and bitcoins: an essay on the ontology of money. *Journal of Institutional Economics*, 12(2):327–347, 2016.

B. Smith. Aristotle, menger, mises: an essay in the metaphysics of economics. *Annual supplement to History of political economy*, 22:263–287, 1990.

B. Smith. Searle and de soto: The new ontology of the social world. In D. M. B. Smith and I. Ehrlich, editors, *The Mystery of Capital and the Construction of Social Reality*, pages 35–51. Open Court, Chicago, USA, 2008.

B. Smith. How to do things with documents. *Rivista di estetica*, 50:179–198, 2012.

J. Smithin. *What is money?* Routledge, London, 2000.

G. Soros. Fallibility, reflexivity, and the human uncertainty principle. *Journal of Economic Methodology*, 20(4):309–329, 2013.

R. Starr. The price of money in a pure exchange monetary economy with taxation. *Econometrica*, 42(1):45–54, 1974.

R. Starr. *General Equilibrium Models of Monetary Economies*. Academic Press, Studies in the Static Foundations of Monetary Theory. San Diego, California, 1989.

R. Starr. *Why is there Money?* Edward Elgar, Walrasian General Equilibrium Foundations of Monetary Theory. Cheltenham, UK, 2012.

R. Sugden. Credible worlds: the status of theoretical models in economics. *Journal of Economic Methodology*, pages 1–31, 2000.

T. Tahko. Natural kind essentialism revisited. *Mind*, 124(495):795–822, 2015.

A. L. Thomasson. Realism and human kinds. *Philosophy and Phenomenological Research*, 67(3):580–609, 2003.

J. Tiehen. Subset realization and the problem of property entailment. *Erkenntnis*, 79(2): 471–480, 2014.

J. Tirole. Liquidity shortages: theoretical underpinnings. *Banque de France Financial Stability Review: Special Issue on Liquidity*, 11:53–63, 2008.

J. Tirole. Illiquidity and all its friends. *Journal of Economic Literature*, 49(2):287–325, 2011.

R. Townsend. Models of money with spatially separated agents. In K. J. and N. Wallace, editors, *Models of Monetary Economies*, pages 265–303. Federal Reserve Bank of Minneapolis, 1980.

A. Trejos and R. Wright. Search, bargaining, money, and prices. *Journal of Political Economy*, 103(1):118–141, 1995.

UNODC. *Informe de Monitoreo de Territorios Afectados por Cultivos Ilıcitos 2017*. Oficina de las Naciones Unidas contra la Droga y el Delito, 2018.

F. R. Velde, W. E. Weber, and R. Wright. A model of commodity money, with applications to gresham's law and the debasement puzzle. *Review of Economic Dynamics*, 2(1):291–323, 1999.

C. Villalon. Cocaine country. the colombian villages where coke is king. *National Geographic Magazine.*, Jul 2004.

N. Wallace. The overlapping generations model of fiat money. In Wallace and J. Kareken, editors, *N*, pages 49–82. Federal Reserve Bank of Minneapolis, Models of Monetary Economies . Minneapolis, 1980.

N. Wallace. A dictum for monetary theory. *Federal Reserve Bank of Minneapolis Quarterly Review*, 22(1):20–26, 1998.

N. Wallace. Whither monetary economics? *International Economic Review*, 42(4):847–869, 2001.

N. Wallace. Fiat money. In S. Durlauf and L. Blume, editors, *The New Palgrave Dictionary of Economics*. Palgrave Macmillan, 2008.

C. J. Waller. Microfoundations of money: Why they matter. *Federal Reserve Bank of St Louis Review*, 97(4):289–301, 2015.

C. Walsh. *Monetary Theory and Policy (3rd ed.)*. The MIT Press, Cambridge Massachusetts, 2010.

D. Weiskopf. The functional unity of special science kinds. *British Society for the Philosophy of Science*, 62:233–258, 2011.

L. H. White. The market for cryptocurrencies. *Cato J.*, 35:383, 2015.

J. Wilkins. *Species. A History of the Idea*. Berkeley and Los Angeles, California, Berkeley and Los Angeles, California, 2009.

S. Williamson. Is bitcoin a waste of resources? 2018. URL `http://newmonetarism.blogspot.com/2018/01/is-bitcoin-waste-of-resources.html`.

S. Williamson and R. Wright. New monetarist economics: Methods. *Federal Reserve Bank of St Louis Review*, 92(4):265–302, 2010a.

S. Williamson and R. Wright. New monetarist economics: Models. In B. Friedman and M. Woodford, editors, *Handbook of Monetary Economics (Vol. 3A)*, pages 26–94. Elsevier, 2010b.

R. A. Wilson, M. J. Barker, and I. Brigandt. When traditional essentialism fails: biological natural kinds. *Philosophical Topics*, 35(1/2):189–215, 2007.

M. Woodford. Doing without money: Controlling inflation in a post-monetary world. *Review of Economic Dynamics*, pages 173–219, 1998.

R. Wray. From the state theory of money to modern money theory: An alternative to economic orthodoxy. *Working Paper, Levy Economics Institute of Bard College, 792, 1-34*, 2014a.

R. Wray. From the state theory of money to modern money theory: An alternative to economic orthodoxy. *Working Paper, Levy Economics Institute of Bard College*, (792): 1–34, 2014b.

L. Wright. Function. *Philosophical Review*, 82:139–168, 1973.

R. Wright. On the future of macroeconomics: A new monetarist perspective. *Oxford Review of Economic Policy*, 34(1-2):107–131, 2018.

L. Yeager. Essential properties of the medium of exchange. *Kyklos, International Review for Social Sciences*, 21(1):45–69, 1968.

D. Yermack. Is bitcoin a real currency? an economic appraisal. In *Handbook of digital currency*, pages 31–43. Elsevier, 2015.

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Abstract

Abstract

The thesis aims to address two main questions regarding certain features of liquidity-based asset classification. A first question is about the validity of such a classification: Does liquidity-based asset classification pick out a natural kind? I use the case of the category 'liquid assets' to show that liquidity is a functional property that can be realized in two genuinely different ways: monetary trades and credit trades. Accordingly, 'liquid assets' can be regarded as a functional kind with multiple realizations. I also argue that the kind 'liquid assets' earns its credential of natural kind by playing an epistemic role in explanatory economic models. I finally point out that mind-dependence does not threaten realism about the kind 'liquid assets.' The second question is about the extension of the categories resulting from liquidity-based asset classification: Is there a sharp boundary between categories of assets that are classified based on their liquidity? I use the case of 'money' to discuss if it is possible to find an unambiguous distinction between the categories 'money' and 'non-money.' I argue that such a view can be successful only, if following traditional essentialism, there is a set of intrinsic properties that are necessary and sufficient for membership in the natural kind designated by the term 'money.' However, based on what is currently known by monetary economists, there is neither set of intrinsic properties nor necessary and sufficient characteristics that one could use to separate 'money' unambiguously from 'non-money.'

Once the questions regarding the liquidity-based asset classification has been addressed, the thesis directly engages in the study of liquidity. The thesis contributes to the theoretical study of illegal means of payment with the same models developed by monetary economists. Using the case of a community in which an illegal commodity provides liquidity services, the thesis researches the impact of a government policy on the exchange value of such a commodity in internal trade.

Résumé

La thèse vise à répondre à deux questions principales concernant certaines caractéristiques de la classification des actifs fondée sur la liquidité. Une première question porte sur la validité d'une telle classification : la classification des actifs fondée sur la liquidité identifie-t-elle un type naturel ? Je soutiens que le type « actifs liquides » est uni par la propriété fonctionnelle de la liquidité qui peut être réalisée de deux manières véritablement différente : les opérations monétaires et les opérations de crédit. Je soutiens également que le type « actifs liquides » gagne son accréditation de type naturel en jouant un rôle épistémique dans les modèles économiques. Je souligne enfin que la dépendance à l'esprit ne menace pas le réalisme sur le type « actifs liquides ». La deuxième question concerne l'extension des catégories résultant de la classification des actifs fondée sur la liquidité : existe-t-il une frontière nette entre les catégories d'actifs classées en fonction de leur liquidité ? J'utilise le cas de « monnaie » pour discuter s'il est possible de trouver une distinction sans ambiguïtés entre les catégories de « monnaie » et de « non-monnaie ». Je soutiens qu'un tel point de vue ne peut réussir que si, à la suite de l'essentialisme traditionnel, il existe un ensemble de propriétés intrinsèques qui sont nécessaires et suffisantes pour appartenir au type naturel désigné par le terme « monnaie ». Cependant, d'après la connaissance actuelle en économie monétaire, il n'y a ni ensemble de propriétés intrinsèques ni caractéristiques nécessaires et suffisantes que l'on pourrait utiliser pour séparer sans ambiguïtés « monnaie » de « non-monnaie ».

Une fois les questions relatives à la classification des actifs fondée sur la liquidité abordée, la thèse s'engage directement dans l'étude de la liquidité. La thèse contribue à l'étude théorique des moyens de paiement illégaux avec les mêmes modèles développés par les économistes monétaires. En utilisant le cas d'une communauté dans laquelle une marchandise illégale fournit des services de liquidité, la thèse étudie l'impact d'une politique gouvernementale sur la valeur d'échange d'une telle marchandise pour le commerce intérieur.

Résumé substantiel

Liquidité : un concept glissant

La liquidité fait référence à un phénomène complexe aux dimensions multiples, dont certaines se réfèrent à des attributs d'actifs tandis que d'autres à des états de marché ou à des individus (Amihud et al., 2006; Crockett, 2008; Lagos, 2008). Il n'existe actuellement aucune théorie de la liquidité ayant l'ambition d'aborder toutes ces dimensions dans un cadre unique. Au lieu de cela, l'économie et la finance proposent différentes théories conçues chacune pour traiter uniquement une ou plusieurs dimensions de la liquidité. Cette stratégie a certainement eu un impact positif sur le développement d'approches théoriques distinctes et l'épanouissement de travaux innovants. Cependant, un inconvénient est que l'hétérogénéité des approches théoriques a rendu la terminologie plus confuse. Différentes théories comprennent donc la liquidité à leur manière, ce qui a pour conséquence que la liquidité est identifiée à différentes choses selon la branche de la littérature considérée.

La difficulté à déterminer un concept unique de liquidité n'est pas nouvelle. Depuis le début, lorsque Keynes a rendu le mot populaire en économie, la liquidité est un concept glissant. Pour Hicks (1962), une partie du glissement est dû aux deux façons dont Keynes a introduit le concept de liquidité. D'une part, la liquidité a fait son chemin dans le monde de l'économie théorique à travers *The General Theory* et l'argument de la préférence de liquidité. D'autre part, la liquidité est également arrivée dans le monde des banquiers grâce à la contribution de Keynes au rapport Macmillan et *The Treatise on Money* (Beggs, 2015). En effet la notion de liquidité décrite dans The Treatise n'est pas la même que la préférence de liquidité et est plutôt plus proche de ce que l'on appellera ci-dessous la liquidité du marché.

Actuellement les usages de la liquidité en économie et en finance ont tendance à tomber dans l'un des quatre sens suivants. Premièrement, la liquidité peut se référer à *la liquidité de la banque centrale* qui est un terme qui décrit les réserves détenues par les institutions financières de la banque centrale (Cecchetti et Disyatat, 2010). Ces réserves permettent aux institutions financières de satisfaire aux exigences de réserves ou de parvenir au règlement final des transactions dans le système de paiement. Deuxièmement, la liquidité peut être comprise comme *la liquidité de financement*, un terme qui décrit la capacité d'un individu ou d'une institution à lever des fonds à court terme en empruntant ou en vendant des actifs (Brunnermeier et Pedersen, 2009). Troisièmement, la liquidité peut également faire référence à *la liquidité du marché*. Ce type de liquidité est largement étudié en finance et décrit la facilité et la rapidité avec lesquelles un actif peut être converti en espèces (Mishkin et Eakins, 2018). Ainsi, la liquidité du marché comprend des éléments de temps, de volume et de coûts de transaction (Nikolaou, 2009).

Un quatrième sens dans lequel la liquidité peut être comprise est celui de *la liquidité d'échange*, principalement étudié par les économistes monétaires (Lagos, 2008). Les économistes monétaires ont utilisé la notion de liquidité d'échange pour expliquer la valeur de la monnaie fiduciaire, c'est-à-dire un objet qui n'a pas de valeur intrinsèque et n'est pas convertible. En effet, un billet d'un dollar est un actif énigmatique : que

pouvez-vous faire avec un billet d'un dollar ? Si l'on est adepte de l'origami, vous pourriez peut-être faire une grue en papier ; mais la plupart d'entre nous ne sont malheureusement pas si adroits. Il est également regrettable qu'un billet d'un dollar, qui est du papier, n'est pas désiré pour ses qualités intrinsèques, par exemple pour dessiner. Néanmoins, dans de nombreux métiers, les gens acceptent facilement un billet d'un dollar comme moyen de paiement pour un bien ou un service. Le mystère est alors qu'un billet d'un dollar est un actif ayant une valeur commerciale positive, mais dont la valeur fondamentale est nulle.

L'économie monétaire a répondu à ce mystère, l'idée de base étant que sans moyen de paiement, les gens ne pourraient pas effectuer de nombreux échanges mutuellement bénéfiques. Un billet d'un dollar est ainsi valorisé positivement car il facilite les échanges. Cependant, les actifs peuvent faciliter l'échange de plusieurs manières. L'une est certainement en étant utilisée comme moyen de paiement ; un autre, en servant de garantie. Prenons, par exemple, un ménage qui obtient du vendeur une ligne de crédit à la consommation garantie par une hypothèque. Au-delà des complexités contractuelles, la maison physique est un actif qui fonctionne comme une garantie et permet au ménage d'acquérir directement des biens et services auprès du vendeur. Qu'ils agissent comme des moyens de paiement ou comme des garanties, les actifs fournissent ce que les économistes monétaires appellent techniquement des services de liquidité.

La liquidité du marché diffère de *la liquidité d'échange* en ce qu'elle se concentre sur la capacité directe d'un actif à faciliter l'échange. Bien qu'un billet d'un dollar puisse être utilisé directement dans le commerce pour acheter des biens et des services à des vendeurs, d'autres actifs financiers doivent d'abord être vendus, et ce n'est qu'ensuite que l'argent collecté peut être utilisé pour effectuer des paiements. À cet égard, ces actifs financiers sont considérés comme ayant une capacité indirecte à faciliter l'échange.

Je m'intéresse principalement à la capacité *directe* des actifs à faciliter les échanges. Par conséquent, dans le reste de la thèse, sauf indication contraire, j'entends la liquidité comme liquidité d'échange. Pour les économistes monétaires, une telle notion de liquidité fait référence au *degré* auquel les actifs sont utiles soit comme moyen de paiement, soit comme garantie pour faciliter les transactions (Lagos, Rocheteau et Wright, 2017).

Classification des actifs en fonction de la liquidité et types naturels (*natural kinds*)

La liquidité est une propriété qui ouvre la possibilité de concevoir une taxonomie des actifs. La classification des actifs la plus populaire est peut-être celle qui fait la distinction entre « monnaie » et « non-monnaie ». Nous pourrions, par exemple, affirmer qu'un actif appartient à la catégorie « monnaie » si un tel actif fonctionne comme moyen de paiement. Par conséquent, si l'actif en question est un billet d'un dollar, nous pouvons conclure qu'il appartient à de la « monnaie ». Cependant, la liquidité a été définie ci-dessus en termes *d'actifs qui facilitent les transactions* plutôt que simplement en termes *d'actifs qui sont un moyen de paiement*. En ce sens, il existe d'autres

façons de classer les actifs en fonction de la liquidité. Nous pourrions alors dire que tout actif qui fournit des services de liquidité, soit comme moyen de paiement soit comme garantie appartiendra à une catégorie que nous déciderons d'appeler « actifs liquides ». Ainsi, par exemple, à la fois un billet d'un dollar qui est largement utilisé en tant que moyen de paiement et un bon du Trésor largement accepté comme garantie appartiendra aux « actifs liquides ».

Le classement des actifs en fonction de leur liquidité soulève quelques questions. Cependant, pour présenter avec précision de telles questions, nous devons d'abord introduire une distinction faite par les philosophes entre deux sortes de classifications. D'une part, il existe des classifications qui sont purement arbitraires. Par exemple, imaginons que nous créons arbitrairement la catégorie « objets qui se trouvent actuellement dans mon champ visuel » (Koslicki, 2008). Cette première sorte de classification correspond à ce que les philosophes appellent des types fallacieuses ou arbitraires. D'un autre côté, il existe des classifications qui, plutôt que d'imposer une division au monde, capturent une division trouvée dans le monde. Un exemple standard est la catégorie « cuivre » (Brzovic, 2019). Cette sorte de classification correspond aux *types naturelles (natural kinds).*

Bien qu'il existe différentes théories des types naturels, nous pouvons identifier au moins deux caractéristiques génériques (Brzovic, 2019). Tout d'abord, un type naturel fait référence à un ensemble de propriétés partagées par tous les membres du type. Deuxièmement, les propriétés partagées par les membres d'un type naturel ne sont pas accidentelles ; il doit y avoir une explication pour ce regroupement de propriétés.

Le contraste avec les types arbitraires aide à comprendre la raison pour laquelle les types naturels sont précieux pour l'activité scientifique. Revenons à l'exemple de la catégorie « objets qui sont actuellement dans mon champ visuel ». Si nous tentons de l'utiliser pour faire des inférences inductives sur des membres non encore observés, nous arriverons sûrement à la conclusion qu'une telle catégorie ne fonctionne pas bien. En revanche, les catégories qui correspondent aux types naturels jouent un rôle dans le soutien de l'inférence inductive. En particulier, la connaissance des membres actuels d'un type naturel peut fonder des inférences inductives sur des objets nouveaux ou hypothétiques qui ont sans doute le même type d'appartenance (Hacking, 1991 ; Brigandt, 2011). De plus, les types naturels peuvent soutenir l'explication scientifique. Si l'on approuve, par exemple, le point de vue selon lequel l'explication scientifique doit s'appuyer sur des lois scientifiques, alors on peut affirmer que les types naturels justifient des généralisations inductives, à l'instar des lois.

Pour résumer, les types naturels nous permettent de faire des inférences inductives fiables. Les propriétés partagées par tous les membres de la nature ne sont pas un simple produit du hasard. Il doit y avoir une explication pour les propriétés associées à un type naturel. Nous pouvons alors faire la déduction inductive correcte qu'un membre non observé possédera les mêmes propriétés que les membres qui ont déjà été observés.

La thèse vise à répondre à deux questions principales concernant certaines caractéristiques de la classification des actifs fondée sur la liquidité. Une première

question porte sur la validité d'une telle classification : *la classification des actifs fondée sur la liquidité identifie-t-elle un type naturel ?* Les implications de cette interrogation ne sont pas triviales. Certains philosophes ont soutenu que les sciences sociales sont trop limitées pour produire des connaissances sur leur sujet, car il n'y a pas de types naturels dans leur domaine (Ellis, 2002/2014). En l'absence de types naturels, selon l'argument, les sciences sociales n'ont pas accès à ce support inductif et explicatif et sont donc sujettes à de moins bons résultats scientifiques. En effet, ce raisonnement a été adopté par des philosophes qui voient dans le prétendu manque de types naturels la principale raison pour laquelle l'économie, malgré son formalisme mathématique avancé, n'a pas réussi à atteindre le succès scientifique des sciences naturelles.

Rosenberg (1992), par exemple, a affirmé que l'économie n'avait guère progressé dans l'amélioration de sa capacité de prédiction, car ses catégories de base comme les « croyances » ou les « désirs » sont des variables intentionnelles qui appartiennent au domaine de la psychologie populaire. Ainsi, à son avis, ces catégories n'ont pas la capacité des types naturels de soutenir les inférences inductives. Nelson (1990) a également approuvé une position similaire mais, contrairement à Rosenberg (1992), situe le problème dans la catégorie des « marchandises ».

Dans une première critique de Rosenberg (1992) et Nelson (1990), Kincaid (1995) soutient que ces diagnostics souffrent du même problème : ils traitent l'économie comme un tout homogène, ignorant ainsi la diversité de la recherche économique. La thèse ne s'engage pas dans le projet de discuter de l'existence des types naturels dans l'économie dans son ensemble, mais se concentre plutôt sur un objectif plus particulier, à savoir déterminer si la classification des actifs fondée sur la liquidité désigne un type naturel ou non.

La deuxième question concerne l'extension des catégories résultant de la classification des actifs en fonction de la liquidité : *existe-t-il une frontière nette entre les catégories d'actifs classées en fonction de leur liquidité ?* Cette question est liée aux débats philosophiques sur les frontières des types naturels. Les théories standard des types naturels ne s'entendent pas sur le caractère net ou flou de telles frontières. La thèse s'engage dans ce débat philosophique, bien que dans le but de tirer des conclusions qui dépassent le domaine de la philosophie.

Les économistes discutent depuis longtemps des critères qui permettent de classer les actifs en catégories distinctes (Friedman, 1956 ; Friedman et Schwartz, 1970). Les économistes ont par exemple présenté des arguments pour déterminer si les crypto-monnaies devaient être considérées comme monnaie ou non. Yermack (2015), notamment, a souligné que le bitcoin semble être un investissement spéculatif plutôt qu'une monnaie car il ne remplit pas pleinement les fonctions standard de la monnaie. En revanche, Hazlett et Luther (2019) soutiennent que le seul critère requis pour classer un article comme monnaie est qu'il fonctionne comme un moyen d'échange communément accepté. Ils constatent que dans certaines transactions internet, le bitcoin est couramment utilisé comme moyen d'échange.

Contrairement à ces approches, la thèse cherche à éclairer ce débat en adoptant la perspective des types naturels. Smit et al. (2016) ont fait valoir qu'une stratégie

potentielle pour déterminer si le bitcoin est ou n'est pas de la monnaie consiste à décider si le bitcoin possède les propriétés communes qui définissent l'appartenance au type naturel « monnaie ». Cependant, on peut alors se demander si les limites de catégories telles que comme « monnaie » et « non monnaie » sont clairement définies. Après tout, ce type de frontière n'est pas tout à fait rare en science comme c'est le cas pour la classification des éléments chimiques dans laquelle la transition entre les catégories distinctes n'est pas progressive (Ellis, 2002/2014). La thèse examine donc si ce qui est réalisé dans le cas des éléments chimiques peut également être appliqué aux actifs utilisés dans les paiements comme le bitcoin. En d'autres termes, l'objectif est de déterminer si la classification des actifs fondée sur la liquidité entraîne une rupture discrète entre les catégories ou si la distinction n'est qu'une question de degré.

Deux théories des types naturels

Au-delà des caractéristiques génériques ci-dessus, les théories des types naturels possèdent des différences sur les détails de ce qu'il est nécessaire d'exhiber pour qu'une classification compte comme une classification de type naturel. Il existe deux théories standard sur les types naturels : *l'essentialisme* et *la théorie des clusters de propriétés homéostatiques*.

Essentialisme

L'essentialisme est encore la théorie dominante des types naturels. Pendant longtemps, l'essentialisme a été considéré comme une philosophie aristotélicienne dépassée. Cependant, ce point de vue a changé avec les travaux de Kripke et Putnam qui ont ravivé l'essentialisme et l'ont rendu à nouveau respectable (Ellis, 2002/2014). J'ai mentionné ci-dessus que les membres d'un type naturel partagent de manière non accidentelle un ensemble de propriétés. L'essentialisme offre une caractérisation de ces propriétés dans lesquelles elles sont représentées comme formant une essence naturelle. Ainsi, pour les essentialistes, ce qui distingue véritablement les types naturels des types non naturels, c'est que ces dernières manquent d'essences.

Les essentialistes conviennent avec les non-essentialistes que les types naturels soutiennent les inférences inductives. Cependant, les essentialistes affirment que c'est l'existence d'une essence qui justifie qu'une catégorie donnée puisse jouer un rôle de soutien au raisonnement inductif. Il n'y a pas de consensus parmi les essentialistes sur les caractéristiques exactes d'une essence, mais certaines caractéristiques qui apparaissent dans la littérature essentialiste sont les suivantes : nécessité et suffisance, nécessité modale, le fait que ces caractéristiques doivent être intrinsèques. En outre, certains essentialistes ont également soutenu que les propriétés essentielles génèrent des frontières nettes entre les types naturels et fournissent une hiérarchie des types naturels de sorte qu'elles ne peuvent pas se recouper.

Comme les essentialistes ne sont pas d'accord sur les caractéristiques exactes des essences, cela a conduit au développement de plusieurs versions de l'essentialisme

souscrivant chacune à une combinaison différente d'exigences. Une version bien connue de l'essentialisme est ce que l'on appelle l'essentialisme traditionnel (Wilson et al., 2007). Les essentialistes traditionnels affirment qu'une essence de type naturel est l'ensemble des propriétés intrinsèques qui sont nécessaires et suffisantes pour appartenir à un type particulier. Comme l'essence du type naturel ne comprend que les propriétés intrinsèques des membres du type, les essentialistes traditionnels prétendent que les frontières entre les catégories distinctes ne sont pas le résultat d'une imposition humaine mais plutôt le reflet de divisions existant dans la nature. De même, comme ces propriétés intrinsèques sont individuellement nécessaires et conjointement suffisantes pour appartenir à un type il existe alors, pour l'essentialisme traditionnel, une rupture discrète entre des types naturels distincts (Ellis, 2002/2014). Le cas des éléments chimiques mentionnés précédemment est précisément un exemple paradigmatique d'une classification qui répond aux exigences de l'essentialisme traditionnel. Par conséquent, dans la version de l'essentialisme traditionnel, une essence permet de délimiter nettement les frontières des types naturels.

L'essentialisme jouit toujours d'une forte adhésion dans certains cercles philosophiques (Ellis, 2002/2014). Cependant, il a également été la cible de sérieuses critiques de la part de philosophes qui estiment que l'essentialisme ne peut pas rendre compte des types dans les sciences spéciales, qui sont généralement caractérisées en termes de propriétés relationnelles, fonctionnelles ou historiques plutôt que de propriétés intrinsèques. Plus surprenant peut-être, certains philosophes ont soutenu qu'au moins certaines exigences essentialistes sont même violées par certains types paradigmatiques de physique et de chimie (Needham, 2011 ; Tahko, 2015; Khalidi 2016).

Clusters de propriétés homéostatiques (CPH)

Une alternative populaire à l'essentialisme est la théorie des *clusters* de propriétés homéostatiques (CPH) développée par Richard Boyd (1999). La théorie CPH s'écarte de l'essentialisme et accorde plus d'attention aux détails des catégories proposées par les sciences spéciales. En effet, la théorie CPH peut être considérée comme un effort pour mettre en évidence certaines lacunes de l'essentialisme tout en préservant l'idée qu'il existe des types naturels dans le domaine des sciences spéciales. La théorie CPH ne prétend pas que les membres d'un type naturel sont regroupés parce qu'ils possèdent tous le même ensemble de propriétés, c'est-à-dire une essence. Au lieu de cela, la théorie CPH soutient que les types dans les sciences spéciales correspondent plutôt à un cluster de propriétés. La liste suivante résume les principales caractéristiques des espèces naturelles selon la théorie de l'CPH : groupe de propriétés, mécanisme homéostatique, importation causale, accommodement.

En décrivant les types naturels comme correspondant à un groupe de propriétés, la théorie CPH refuse l'exigence essentialiste qu'il existe un ensemble de propriétés individuellement nécessaires et conjointement suffisantes qui définissent l'appartenance à un type. Les propriétés de la grappe sont vaguement associées entre elles, c'est-à-dire que la présence d'une propriété rend plus probable l'occurrence d'une autre propriété, mais une telle co-occurrence peut ne pas se produire chez

certains individus. La théorie du CPH est donc plus permissive que l'essentialisme dans la mesure où les membres d'une espèce peuvent partager beaucoup, mais pas nécessairement toutes les propriétés formant le cluster (Khalidi, 2016). De plus, la théorie CPH n'exige pas que les propriétés soient intrinsèques. Les cas de types naturels généralement étudiés par la théorie CPH présentent des propriétés relationnelles ou extrinsèques. En conséquence, pour la théorie CPH, les frontières des types naturels sont plutôt floues et il n'y a donc pas de rupture discrète entre les types naturels distincts.

La théorie CPH soutient que les propriétés ne sont pas associées les unes aux autres par hasard. Au lieu de cela, il existe un mécanisme causal qui est à la fois responsable de la création du groupe de propriétés et de son maintien en équilibre. Le mécanisme causal rend également une autre fonction dans la théorie CPH. Pour les essentialistes, les types naturels sont individualisées par la possession de l'ensemble des propriétés formant l'essence du type naturel. En revanche, la théorie CPH ne peut pas utiliser le cluster de propriétés pour individualiser les types car l'extension des types naturels est floue. Ainsi, pour décider si un individu donné appartient à un certain type, la théorie CPH utilise le mécanisme causal qui maintient le cluster de propriétés en place (Craver, 2009 ; Khalidi, 2016).

Selon la théorie CPH, les types naturels participent à d'importantes généralisations. Les types naturels figurent dans les théories scientifiques, soutenant l'inférence inductive et l'explication. Par conséquent, la théorie CPH exclut les catégories ayant une valeur épistémique faible ou nulle (Craver, 2009). En outre, la théorie CPH propose la « thèse de l'accommodation », c'est-à-dire l'affirmation selon laquelle nous concevons nos catégories d'une manière qui nous permet d'accommoder la structure causale du monde. Si certaines catégories réussissent à soutenir des généralisations inductives fiables, c'est parce que la relation proposée entre des catégories distinctes est le reflet de la structure causale du monde.

Jusqu'à présent la distinction entre les types arbitraires et les types naturels a été faite en termes de classifications qui, d'une part, imposent une division à la nature et d'autre part des classifications qui ne font que refléter une division de la nature existante. Cependant, nous avons vu ci-dessus que les limites des types naturels sont floues et que les scientifiques affinent également leurs catégories pour s'adapter à la structure causale du monde. Ainsi, certains philosophes ont observé qu'une implication de la théorie CPH est que les intérêts humains jouent un rôle dans l'identification des types naturels (Craver, 2009). Les scientifiques décident, en fonction de leurs intérêts explicatifs et prédictifs, des limites définitives entre les différents mécanismes causaux, c'est-à-dire les limites où un mécanisme commence et se termine. Ils décident également des limites d'un cluster de propriétés donné, comme lors de la définition du nombre de propriétés à inclure finalement dans le cluster. L'introduction des intérêts humains ne suffit pas à rendre les types naturels et les types arbitraires indiscernables. Contrairement aux types arbitraires, les types naturels ont un potentiel inductif. Cependant, la théorie CPH rend la position selon laquelle les types naturels reflètent simplement les divisions de la nature et non les nôtres intenables.

Tout au long de la thèse, je discuterai de ces deux théories standard des types naturels, bien qu'avec un accent particulier sur l'essentialisme traditionnel. Je confronterai l'essentialisme traditionnel et en particulier l'idée qu'il est possible d'avoir une rupture discrète entre des catégories distinctes résultant de la classification des actifs en fonction de la liquidité. Même si mon intérêt principal sera consacré à l'argument contre l'essentialisme traditionnel, j'examinerai également la théorie du CPH comme un moyen d'articuler l'une des principales affirmations proposées par la thèse : la classification des actifs en fonction de la liquidité apparaîtra alors mieux comprise à travers une troisième théorie des types naturels, à savoir le *fonctionnalisme*.

Contribution de la thèse

La thèse n'a pas pour objectif de proposer une nouvelle théorie métaphysique sur les types naturels. Je m'intéresse plutôt aux types naturels du point de vue de la philosophie des sciences. Ainsi, la recherche menée contribue à l'étude de l'utilisation et des caractéristiques des types naturels en économie.

La réponse générale donnée par la thèse peut être résumée comme suit. La liquidité peut être utilisée pour créer une taxonomie des actifs dans laquelle ces actifs sont regroupés en catégories, en fonction des services de liquidité qu'ils fournissent. J'utilise le cas de la catégorie « actifs liquides » pour montrer que la liquidité est une propriété fonctionnelle qui peut être réalisée de deux manières véritablement différentes. Les actifs peuvent fournir des services de liquidité par le biais d'opérations monétaires ou d'opérations de crédit. Qu'ils soient échangés via des opérations monétaires ou de crédit, les actifs appartenant au type « actifs liquides » ont une propriété commune : ils sont également évalués par leurs services de liquidité, par conséquent leurs prix peuvent s'écarter de la valeur fondamentale. En conséquence, les « actifs liquides » peuvent être considérés comme un type fonctionnel avec de multiples réalisations.

De plus, la liquidité est une propriété influencée par des pratiques sociales et institutionnelles dans lesquelles l'esprit humain intervient inévitablement. Cependant, une telle dépendance à l'esprit n'empêche pas nécessairement la classification des actifs fondée sur la liquidité d'avoir des pouvoirs de causalité et un potentiel d'induction et d'explication. Le cas des « actifs liquides » illustre que la classification des actifs fondée sur la liquidité peut jouer un rôle épistémique dans les modèles explicatifs. Étant donné sa capacité à fonder l'inférence inductive et l'explication, je conclus que la catégorie « actifs liquides » désigne un type naturel selon l'approche fonctionnaliste.

Une catégorie plus restrictive que les « actifs liquides » est la « monnaie ». La « monnaie » comprend tous les actifs qui ont atteint un certain seuil de liquidité en servant de moyen de paiement via des opérations monétaires ou de crédit. Ainsi, contrairement aux « actifs liquides », la catégorie « monnaie » exclut les actifs servant de garantie. J'utilise le cas de « monnaie » pour discuter s'il est possible de trouver une distinction sans ambiguïtés entre les catégories résultant de la classification des actifs en fonction de la liquidité. Il y a un point de vue en économie qui prétend qu'il y a une rupture discrète entre les catégories de « monnaie » et de « non-monnaie ». Je soutiens

qu'un tel point de vue ne peut réussir que si, à la suite de l'essentialisme traditionnel, il existe un ensemble de propriétés intrinsèques qui sont nécessaires et suffisantes pour appartenir au type naturel désigné par le terme « monnaie ». Cependant, d'après la connaissance actuelle en économie monétaire, il n'y a ni ensemble de propriétés intrinsèques ni caractéristiques nécessaires et suffisantes que l'on pourrait utiliser pour séparer sans ambiguïtés « monnaie » de « non-monnaie ». Ainsi, je soutiens qu'il n'y a rien dans la nature de la monnaie qui puisse être interprété comme une essence.

Les multiples objets acceptés dans le commerce diffèrent par leur degré de liquidité. Puisqu'il n'y a pas de norme absolue de liquidité, la différence entre des objets distincts ne devient pas une différence de nature et reste une différence de degré. Ainsi, les économistes tracent la ligne de démarcation entre les actifs en un point qui convient à un objectif donné : tester une hypothèse, construire un modèle simplifié, prévoir un phénomène, concevoir une politique ou réguler une activité. Aussi, l'approche fonctionnelle que je défends dans la thèse est en accord avec la théorie CPH selon laquelle les intérêts épistémiques des scientifiques jouent un rôle dans la décision de l'extension des types naturels.

Une fois les questions relatives à la classification des actifs fondée sur la liquidité abordée, la thèse s'engage directement dans l'étude de la liquidité. La thèse contribue à l'étude théorique des moyens de paiement illégaux avec les mêmes modèles développés par les économistes monétaires. En utilisant le cas d'une communauté dans laquelle une marchandise illégale fournit des services de liquidité, la thèse étudie l'impact d'une politique gouvernementale sur la valeur d'échange d'une telle marchandise pour le commerce intérieur.

La monnaie n'est pas un nouveau problème en philosophie. Au moins depuis Aristote, les philosophes ont estimé que la monnaie est un phénomène si complexe qui mérite d'être étudié (de Bruin, et. Al., 2018). Dernièrement, il y a eu un regain d'intérêt pour discuter de la nature de la monnaie, en particulier parmi les philosophes dans le champ de l'ontologie sociale. Dans les discussions standard sur l'ontologie sociale, l'exemple du billet d'un dollar a été fréquemment utilisé par les philosophes pour organiser leurs réflexions sur la monnaie. Ce n'est pas que le cas d'un billet d'un dollar ne soit pas intéressant. En effet, l'ontologie sociale a soulevé un certain nombre de points importants concernant le rôle du langage, des règles, des équilibres et des croyances humaines dans la création et le maintien de l'institution de la monnaie à partir de la discussion sur le billet d'un dollar. Cependant, cette façon de penser la monnaie laisse en dehors de nombreuses questions importantes. De fait, une grande partie des transactions courantes ne sont pas effectuées en espèces, mais avec l'aide de certains instruments tels que les dépôts bancaires et les cartes de crédit. En outre, d'autres instruments financiers ont acquis un degré de liquidité important, et ils peuvent être utilisés pour faciliter les transactions soit directement en servant de garantie dans les opérations de crédit ou comme moyen de paiement dans les opérations monétaires, soit indirectement en étant d'abord facilement vendus au comptant. Ce sont toutes des questions qui, tout comme les thèmes généraux du crédit, de la liquidité, des opérations bancaires et des intermédiaires financiers, reçoivent

beaucoup d'attention de la part des économistes monétaires. La thèse contribue ainsi à combler le fossé existant entre l'économie monétaire et l'ontologie sociale en apportant un examen philosophique à la liquidité et au crédit garanti. Il ne fait aucun doute qu'il ne s'agit que d'un petit pas et il reste encore beaucoup à faire.

Organisation de la thèse

CHAPITRE 2. Nouvelle économie monétariste : du problème du prix positif de la monnaie à l'approche des prix des actifs fondés sur la liquidité

La monnaie a été un sujet difficile à atteindre en économie. Il est remarquable que, bien que la monnaie semble indispensable pour effectuer un grand nombre d'activités au jour le jour, dans un paradigme économique de base tel que la théorie de l'équilibre général walrasien, la monnaie ne fait aucune différence dans les résultats économiques que les agents peuvent atteindre. Des questions telles que « pourquoi utilisons-nous la monnaie ? », « Dans quelles condition la monnaie est-il évalué positivement ? » Et « quand la monnaie augmente notre capacité à obtenir de meilleurs résultats » se sont révélées difficiles à résoudre dans la théorie de la valeur que les économistes standards acceptent, qui est conçue pour expliquer le fonctionnement de marchés concurrentiels. Après des efforts considérables, les économistes ont non seulement trouvé un certain nombre de façons distinctes de répondre aux questions ci-dessus, mais ont également développé certaines attitudes envers le sujet de la monnaie.

Les attitudes envers la monnaie peuvent varier considérablement d'un économiste à l'autre. Cependant, pour Kiyotaki et Moore (2001), il existe au moins trois groupes distincts. Un premier groupe estime que la monnaie n'a pas d'importance et peut donc soutenir, par exemple, que les modèles sans monnaie conviennent bien à l'étude de la politique monétaire (Woodford, 1998). Un deuxième groupe estime que la monnaie est important pour la compréhension de la politique économique et la gestion de l'économie. Cependant, ce groupe est satisfait des modèles qui imposent l'utilisation de la monnaie via un raccourci. Le troisième groupe, en revanche, se soucie des fondements de la monnaie et estime donc que l'étude des questions monétaires doit être faite avec des modèles qui expliquent l'utilisation de la monnaie plutôt que de l'imposer.

Dans ce chapitre, je me concentre sur le troisième groupe d'économistes. En particulier, je propose une brève reconstruction des racines historiques et des caractéristiques méthodologiques de la soi-disant nouvelle économie monétariste (NEM), en mettant particulièrement l'accent sur le problème du prix positif de la monnaie et le développement d'une approche des prix des actifs fondés sur la liquidité. L'intégration de la théorie monétaire et de la valeur était une entreprise théorique fondée sur l'hypothèse que la théorie monétaire était le « partenaire faible » de la théorie de la valeur. Ainsi, la première a dû être remodelé selon les principes de la seconde. Après un travail considérable dans la poursuite d'une telle intégration, les difficultés d'introduire de la monnaie dans une économie d'équilibre général walrasien sont devenues plus évidentes.

Une alternative pour éviter de telles difficultés est tout simplement d'imposer l'utilisation d'un moyen de paiement via un raccourci comme MIU ou CIA. Une réaction contre l'utilisation de raccourcis pour la monnaie est synthétisée dans le dicton de Wallace. Selon Wallace, les économistes monétaires sont chargés de rendre compte des raisons pour lesquelles le commerce a lieu avec de la monnaie. Ainsi, au lieu de présupposer une demande de monnaie, l'économie monétaire doit être développée à partir de modèles où l'utilisation de la monnaie est endogène. La NEM a approuvé le dicton de Wallace et construit une famille de modèles où la monnaie est essentielle et valorisée positivement dans le commerce. Ces modèles reposent sur la théorie de la recherche et les frictions commerciales pour offrir une description de la façon dont les agents négocient. En outre, une fois que la NEM a établi des modèles dans lesquels la monnaie peut-être évaluée par ses services de liquidité, la NEM a étendu le même mécanisme à tout autre actif qui, dans une certaine mesure, fournit également des services de liquidité. Que la valeur d'un actif puisse être influencée par une prime de liquidité est l'idée de base de l'approche des prix des actifs fondés sur la liquidité.

CHAPITRE 3. L'unité fonctionnelle des « actifs liquides »

La liquidité ouvre la possibilité de concevoir une taxonomie des actifs. Les économistes, par exemple, peuvent regrouper et donner un nom à des actifs qui ont atteint un seuil de liquidité. On peut alors s'interroger sur la validité d'une telle classification : la classification des actifs fondée sur la liquidité est-elle une classification de type naturel ? Contrairement aux types arbitraires, les types naturels sont précieux car ils ont un potentiel inductif et explicatif. Par exemple, les propriétés du type « cuivre » peuvent expliquer pourquoi une instance de « cuivre » conduit l'électricité et nous permettent de déduire qu'une nouvelle instance de « cuivre » conduira également l'électricité.

Les économistes monétaires peuvent utiliser des termes interchangeables comme « monnaie » ou « actifs liquides » pour nommer le groupe d'actifs qui, soit comme moyen de paiement soit comme garantie, ont atteint un seuil de liquidité. Cependant, pour l'objectif du chapitre, le terme monnaie pourrait faire plus de mal que de bien car il va à l'encontre de la pratique encore répandue d'appeler monnaie à des actifs qui ne fonctionnent que comme moyen de paiement (en particulier, la monnaie fiduciaire) ou qui ont d'autres fonctions comme l'unité de compte ou la réserve de valeur. Pour éviter toute confusion, j'utilise le terme « actifs liquides » pour désigner un groupe d'actifs ayant atteint un seuil de liquidité, soit comme moyen de paiement et / ou comme garantie. J'utilise plutôt le terme « monnaie » pour désigner un sous-groupe qui ne fonctionne que comme moyen de paiement.

Le chapitre contribue au débat sur l'existence des types naturels dans le monde social. Mon point principal est que le type « actifs liquides » est un type naturel fonctionnellement défini. Je soutiens que le type « actifs liquides » est uni par la propriété fonctionnelle de la liquidité qui peut être réalisée de deux manières véritablement différente : les opérations monétaires et les opérations de crédit. Je soutiens également que le type « actifs liquides » gagne son accréditation de type naturel en jouant un rôle épistémique dans les modèles économiques. Je souligne enfin

que la dépendance à l'esprit ne menace pas le réalisme sur le type « actifs liquides ».

Une stratégie populaire parmi les philosophes qui cherchent à démontrer la capacité limitée des sciences sociales à produire des connaissances fiables consiste à attaquer la possibilité de trouver des types naturels dans le domaine social (Ellis, 2002/2014 ; Guala, 2016a). Le chapitre montre que les « actifs liquides » peuvent être considérés comme un type naturel. Ainsi, une implication est que les philosophes doivent être plus prudents avant d'adopter une attitude dédaigneuse envers les sciences sociales. Tout au long du chapitre, j'utilise des guillemets pour les termes « actifs liquides » et « monnaie » lorsque je fais référence à des types, mais pas lorsque je considère des instances (membres) de ces types.

CHAPITRE 4. Qu'est-ce qu'on appelle monnaie ? Une évaluation de la vue de monnaie ou non-monnaie.

Ce chapitre est co-écrit avec Gabriel Guzmán.

Qu'est-ce qu'on appelle monnaie ? Au-delà des monnaies nationales telles que le dollar, l'euro ou la livre, que nous convenons tous incontestablement d'appeler monnaie, il est plus difficile et controversé de déterminer si d'autres choses utilisées dans les transactions doivent être appelées monnaie. Le bitcoin, le litecoin, le dogecoin ou l'éthereum, pour n'en nommer que quelques-uns, sont-ils de la monnaie ? La question posée implique le présupposé qu'il existe un ensemble de connaissances qui nous permet de produire une réponse affirmative ou négative. En conséquence, on pense qu'il est possible de distinguer catégoriquement « monnaie » et « non-monnaie ». Souvent, la question « est-ce de la monnaie ? » est posée en économie de l'extérieur, comme l'illustre le cas des crypto-monnaies. Cependant, les économistes ne sont pas seulement les récepteurs d'une demande extérieure de classification entre « monnaie » et « non-monnaie ». Diviser avec précision certains objets en « monnaie » et en « non-monnaie » a en effet toujours été un objectif au sein de la discipline.

Pour définir clairement notre objectif dans ce chapitre, une caractérisation doit être introduite. Nous appelons ainsi le point de vue selon lequel il existe un ensemble de caractéristiques définissant la monnaie et la rend catégoriquement différente des autres choses, *la vue de monnaie ou non-monnaie*. La différence entre monnaie et non-monnaie est une question de nature et non de degré. Nous montrons le lien entre *la vue de monnaie ou non-monnaie* et la discussion philosophique classique sur l'existence d'essences.

Dans la version de l'essentialisme étudiée dans ce chapitre, une essence de type naturel est comprise comme l'ensemble des caractéristiques qui sont appelées les propriétés intrinsèques qui sont nécessaires et suffisantes pour l'appartenance à un type particulier. Nous souhaitons discuter de l'applicabilité potentielle de l'essentialisme traditionnel au cas de la monnaie. S'il est applicable, les économistes pourraient catégoriquement distinguer, comme les chimistes peuvent le faire avec des éléments chimiques, entre « monnaie » et « non-monnaie », et l'objectif de *la vue de monnaie ou non-monnaie* serait réalisable.

Dans ce chapitre, nous contestons *la vue de monnaie ou non-monnaie* et l'essentialisme traditionnel que ce point de vue approuve. Pour que *la vue de monnaie ou non-monnaie* soit pertinente, il est nécessaire que les objets appelés monnaie soient

catégoriquement distincts de ceux appelés non-monnaie. Ceci est possible si, suivant l'essentialisme traditionnel, une transition progressive entre monnaie et non-monnaie ne se produit jamais. Nous plaidons donc contre *la vue de monnaie ou non-monnaie* en critiquant l'essentialisme traditionnel qui sous-tend ce point de vue. Plus précisément, nous soulignons que sur la base de ce que les économistes monétaires connaissent actuellement, il n'existe aucun ensemble de propriétés intrinsèques qui forment l'essence naturelle de la monnaie.

En revanche, nous décrivons ce que nous appelons *la vue du degré de liquidité*. De ce point de vue, parce que les objets sont évalués en fonction du degré auquel ils sont acceptés dans le commerce, il n'y a pas de norme absolue mais plutôt une échelle qui reflète divers degrés de liquidité. Il n'est pas surprenant que l*a vue du degré de liquidité* remette en question l'objectif de tracer une ligne de démarcation nette entre monnaie et non-monnaie. Une implication pratique du point de *vue du degré de liquidité* est que la question de savoir si le bitcoin est ou non une monnaie doit être abandonnée. Le Bitcoin peut être décrit comme un moyen de paiement avec un faible degré d'acceptabilité.

CHAPITRE 5. Base de coca comme monnaie : valeur d'échange et politique antistupéfiants

Dans les régions productrices de coca en Colombie, la base de coca est utilisée comme moyen de paiement. Ces régions sont situées dans des zones reculées qui manquent de la présence institutionnelle de l'État, d'une infrastructure de transport adéquate et d'opportunités économiques légales. Les agriculteurs tirent principalement leurs revenus de la vente de base de coca à de grands producteurs de cocaïne, qui transforment ensuite la base de coca en cocaïne. Cependant, pendant les saisons sèches ou lorsque les acheteurs de base de coca ne peuvent pas visiter fréquemment la région, les agriculteurs souffrent d'une pénurie de monnaie officielle (Villalon, 2004). La base de coca devient alors elle-même un moyen de paiement largement utilisé qui circule avec la monnaie officielle.

La base de coca est un intrant pour la cocaïne finale et sa production fait donc partie d'une activité illégale. Les saisies de cocaïne représentent une perte économique pour les producteurs de cocaïne et les trafiquants de drogue, tandis que les saisies de la base de coca sont principalement une perte pour les producteurs de plants de coca. Étant donné que la base de coca n'est pas seulement vendue aux producteurs de cocaïne, mais utilisée comme moyen de paiement pour le commerce intérieur, une question qui se pose est la suivante : comment une politique anti-drogue telle que les saisies de la base de coca affectent la valeur d'échange de la base de coca dans le commerce intérieur ? Le but de ce chapitre est de répondre à cette question avec un modèle dans lequel les agents décident de manière endogène d'accepter la base de coca comme moyen de paiement. Le modèle permet également d'étudier d'autres questions : quel est l'effet des saisies de la base de coca sur l'effort mis par les agents pour rencontrer un partenaire commercial ? Pour produire de la coca-base ? Les agents produisent-ils plus ou moins de coca-base lorsqu'il existe une probabilité plus élevée de saisie ? Ce chapitre construit un modèle théorique de prospection pour étudier ces questions.

Le modèle montre que si la probabilité de subir une saisie est suffisamment

faible, les détenteurs de la base de coca ne commerceront pas avec des intermédiaires et conserveront la base de coca pour les échanges futurs avec les producteurs. En équilibre, la base de coca sera toujours acceptée dans le commerce mais n'est valorisée que par les services de liquidité qu'elle rend. En revanche, si la probabilité de subir une saisie est suffisamment élevée, les détenteurs de la base de coca commerceront toujours avec des intermédiaires. Dans un tel cas, la base de coca est également valorisée comme intrant pour la cocaïne finale. Tant que la valeur d'échange contient une composante de valeur intrinsèque actualisée positive, la base de coca, en équilibre, sera toujours acceptée dans le commerce. Une forte probabilité de subir une saisie diminue la valeur d'échange de la base de coca, indépendamment du fait que le commerce avec les intermédiaires ait lieu ou non. Cependant, seule une politique extrêmement forte de saisies de la base de coca qui fait converger vers zéro la valeur intrinsèque actualisée pourrait conduire la base de coca hors de la circulation.