

# **MONETARY THEORY CHOICE: SEARCHING FOR THE FIRST PRINCIPLES**

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## **Abstract**

This paper seeks to contribute to understanding theory choice in economics. It proposes an ontological choice criterion: when faced with rival theories, economists might choose the one that provides information on the nature of its subject matter. The role played by the Wallace dictum in monetary economics is used as evidence in support of this claim. Specifically, I argue that the dictum can be interpreted as a call to develop a foundational theory of monetary exchange. Since satisfying this dictum was considered a characteristic of good theory, this became a choice criterion among competing approaches. As the dictum implies that monetary theory must include the use of money as an outcome rather than an assumption, I also note that such a foundational theory can inform us about the ontology of monetary exchange and money.

**Key words:** Ontology, monetary exchange, Wallace dictum, money, theory choice.

## INTRODUCTION

This paper seeks to contribute to understanding theory choice in economics. Mäki (2001) identified two broad classes of choice criteria in the specialized literature. The first class includes “empirical criteria”, according to which economists test empirically competing approaches and then, under predefined decision rules, choose a particular one. However, as research on empirical criteria progressed, it was discovered that empirical tests had only a limited influence on theory choice at best (de Marchi and Blaug, 1991). This led to the development of a second class, which Mäki (2001) called “social criteria.” This second class states that economic theories have social attributes that are of importance in the process of theory choice. For example, an economist could choose a theory based on the academic prestige of the economists who formulated that particular theory (Romer, 2016), or alternatively based on the persuasive devices of theory (McCloskey, 1994).

However, Mäki (2001) also proposed a third class to group “ontological criteria.” Ontology is often regarded as the study of what exists. Nonetheless, discussions about the ontology of human society have tended to pursue a different but related goal, i.e., the study of “stuff” the social world is made of. The attainment of this goal usually implies to address questions such as: What is the constitution of a social entity? How is such an entity built? What is that entity? By way of answering these types of questions, social ontology can provide us with an account of the *nature* of the social reality. Although ontology was originally only a philosophical project, the scientific achievements in different fields have made science our best guide on the ontology of the world. However, there is only a high degree of consensus among philosophers on this issue for the natural sciences. Overall, the social sciences do not receive the same respect, and are often viewed with mistrust and sometimes even with contempt. In confrontation with this view, others philosophers have defended the ability of the social sciences to yield knowledge about the nature of the social world (Guala, 2016; Kincaid, 2012). This paper adopts this positive attitude regarding the scientific outcomes of economics. If we wish to gain insight into the nature of economic reality, economics must be taken seriously.

Nevertheless, the main goal of this paper is not to discuss thoroughly the ontology of monetary exchange embedded in a certain type of monetary theory. Instead, the aim of this paper is to propose a choice criterion that falls within the third class discussed above: economists might prefer a theory that informs us about the nature of its subject matter. In support of this claim, the paper reviews the case of monetary economics and argues the theory choice made by a group of monetary economists can be interpreted as an ontology-based choice. More specifically, it shows that rival theories were dismissed because they did not have an ontology of monetary exchange.<sup>1</sup> Those economists pushed monetary theory down to a deeper level and developed an account from *first principles*. That is, instead of assuming the use of money, this theory starts clarifying the fundamental reasons that give rise to monetary exchange. As the use of money in this approach is an outcome rather than an assumption, I note that such a foundational theory can inform us about the ontology of monetary exchange and money.

The paper is organized as follows. In the first section, I examine how economists tackled the integration of money into value theory. After Hahn’s (1965) work, it became increasingly clear that such an integration was doomed to fail. Faced with these difficulties, economists utilized shortcuts to introduce money in economic modeling. The most representative approaches are

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<sup>1</sup> Monetary exchange is understood as a transaction technology characterized by the widespread use of money in trade.

money-in-the-utility function and cash in advance, which are presented in the second section. Although such shortcuts are useful to think of some substantive macroeconomic issues, they simply presuppose the use of money. This is the complaint contained in Wallace's (1998, 21) dictum: "Money should not be a primitive in monetary theory." In the third section, I argue that the monetary economists that explicitly accepted the dictum of Wallace and discarded shortcut approaches were indeed invoking an ontological criterion. In the fourth section, I synthesize the path that these economists followed to develop a foundational monetary theory. I also briefly describe some characteristics of the ontology of monetary exchange and money resulting from this theory. Finally, I present a few key conclusions.

Two clarifications must be made before we begin. First, this paper does not proceed from a well-established philosophy that tells you what economists ought to do when confronted with rival theories. Instead, it examines economists' scientific practices and then attempts to clarify the ontological criterion that led a group of economists to prefer one over other competing approaches. Second, this paper does not claim that the ontological criterion found is sufficiently general to account for any theory choice in economics. This criterion seeks to complement, rather than to replace, the aforementioned choice criteria, thus enlarging the methodological tools with which philosophers and economists can disentangle the actual process of theory choice.

## 1. HISTORICAL BACKGROUND

Despite the efforts of a number of great economists, the monetary theory at the end of the last century was not in a satisfactory state. Hellwig (1993, 215) wrote "I believe that we do not yet have a suitable theoretical framework for studying the functioning of a monetary system." In a starker description, Banerjee and Maskin (1996, 955) concluded "[m]oney is something of an embarrassment to economic theory." This negative balance is partly due to difficulties faced by those economists who, in a project that has its roots in Walras and that extended well into the twentieth century, sought the integration of monetary and value theory. Though this section provides a summary of such difficulties, it is not intended to be exhaustive.<sup>2</sup> It rather aims to illustrate the theoretical circumstances in which a group of monetary economists appealed an ontological choice criterion and developed a foundational monetary approach. The general premise of the project of integrating monetary and value theory was well expressed by Ostroy:

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 (Ostroy 1987, 6737).

Money was initially thought of as an epiphenomenon in the Walrasian general equilibrium tradition (Ostroy, 1987; Benetti, 2004). In a first stage of research, value theory had to determine the equilibrium values of relative prices. Later, once value theory had completed its work, monetary theorists were tasked to find absolute prices in the monetary sector. This subordinate role of monetary theory was the subject of intense debate among monetary economists, who especially from Patinkin's (1965) pioneering work, became increasingly aware of the complications associated with both introducing the money merely up to a second stage and with constructing a monetary theory in line with the principles of value theory.

Patinkin (1949, 1950-1951, 1951, 1965) opposed the dichotomization of the economic system between a real sector that determined relative prices and a monetary sector that determined

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<sup>2</sup> For a more detailed presentation, see Ostroy and Starr (1990) and Gale (2008).

absolute prices. He not only questioned the consistency of the real-monetary dichotomy, but also showed that once such an inconsistency is settled, traditional analysis still left absolute prices indeterminate.<sup>3</sup> In his own 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 (Patinkin, 134, 1951).

Traditional analysis considered that excess demand functions for goods in the real sector depended only on relative prices, whereas in the monetary sector, excess demand functions for money depended only on absolute prices. Moreover, in an economy with  $n$  goods, the  $n$ th good being money, it is known by Walras' Law that if the  $n-1$  good markets are in equilibrium, the  $n$ th market (i.e., the monetary sector) must also be. Patinkin further showed that the resulting excess demand function for money was homogeneous of degree one in prices.<sup>4</sup> Thus, in the later stage, what follows is simply to add a money equation that permits to determine the absolute price level.

Patinkin however noted that the excess demand function for money in equilibrium assumed in the second stage was not homogeneous of degree one in prices, which is inconsistent with the homogeneity found in the first stage. Of course, one way to solve this inconsistency is simply to assume an excess demand function for money that is homogeneous of degree one. Nonetheless, although the inconsistency disappears in this case, other difficulties persist. Let us suppose we have an economic system in equilibrium. Subsequently, all absolute prices double so that the relative prices remain unchanged and thus, the goods market continues to be in equilibrium. By Walras' Law, it is then expected that the money market is in equilibrium too. However, all absolute prices have doubled and there are no forces in the system to bring them back to their initial levels. Thus, the new set of absolute prices must also be considered an equilibrium set. More generally, any multiple  $\lambda$  of the initial set is also a set of equilibrium absolute prices. Accordingly, the absolute price level in the traditional analysis remains indeterminate.

Research on the existence of 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. In this work, the author offered a demonstration of the existence of equilibrium that "constitue une étape définitive pour la théorie de l'équilibre général" (Cot and Lallement 2006, 385). This was until 1962, during a conference held at the Abbey of Royaumont, France, when Hahn presented a paper that aimed to shorten the distance separating monetary theory from the equilibrium general 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 (Hahn 1965, 126).

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<sup>3</sup> Patinkin initially directed his attack on the so-called classical monetary theory (Patinkin, 1949). Later, he pointed out that the dichotomization also "has neoclassical roots" (Patinkin 1965, 174). This was a source of controversy since some economists considered 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.

<sup>4</sup> See the proof in Patinkin (1949).

For Hahn (1965), the proof of the existence of a general equilibrium in an economy with fiat money had to offer answers to two key questions. First, it must explain how the price of money is determined. Second, it must show the conditions under which money displays an equilibrium positive price. In this regard, Hahn explicitly established the positivity of money price as a problem of monetary theory. Though money can provide a useful service lubricating exchanges, this does not guarantee a non-zero price of money, nor does it assure a positive demand for money. In the case where the price of money falls to zero, agents would no longer be able to buy anything with such a money as nobody would be willing to accept it. For money to play a role in transactions, it must first display a positive price. As Starr (1989) put it “[p]ositivity is a necessary condition for usefulness” (Starr 1989, 295). In examining the results of Patinkin’s monetary model, Hahn concluded:

We are told that the demand for fiat money depends on its exchange value (absence of “money illusion”). 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 (Hahn 1965, 128).

This problem could be addressed by restricting the price of money to positive values through ad hoc assumptions. However, in doing so, theory would be skirting the issue rather than confronting it. Starr (1989) mentioned three possible ways of attempting to generate a positive price for money. One is to construct infinite-horizon models whose most representative version is the overlapping generations model (Wallace, 1980). Another is to use agents’ expectations to back the price of money (Grandmont, 1974). And a final way is to employ institutional arrangements, such as taxation, to prevent the price of money from falling to zero (Starr, 1974). Providing a detailed presentation of these models is beyond the scope of this section. Yet, as the difficulties in finding a positive price for money became more evident, mistrust in the ability of general equilibrium to account for money deepened. As Hahn (1983) summed it up, “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” (Hahn 1983, 1).

## 2. SHORTCUTS FOR MONEY

The above difficulties might help explain the widespread use of shortcuts for money in monetary economics. Certainly, such shortcuts are useful insofar as they allow us to investigate important macroeconomic issues. However, they have a common weakness: they leave aside the question of the nature of monetary exchange. Instead of discussing why money is used in transactions, it is simply assumed. The most representative shortcuts available in the literature are money-in-the-utility function (MIU) and cash-in-advance (CIA), which are presented below.

### 2.1 MIU

Historians of economics have traced back the roots of MIU to Walras (Bridel, 2002). Though 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.<sup>5</sup> After having made changes in the time structure of his

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<sup>5</sup> 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).

model, Walras believed that he had found room for money in the utility function of individuals. Following Bridel (1997), it is possible to think of Walras' last monetary model as proceeding through three phases.<sup>6</sup> 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, they 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, 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, introducing money in the utility function does not prove that money has a special role to play in transactions. For these two authors, we could conceive of optimal allocations of endowments 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 could not successfully account for the transactional role of money. Money in the utility function is simply presupposed. Bridel (1997) put it in this way:

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 (Bridel 1997, 119)

Without going into specifics, it can be said that Walras' intuition would be utilized 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.<sup>7</sup>

The utility function of representative household 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. Utility is increasing and strictly concave in both arguments. It is also continuously differentiable. Thus, 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 must choose

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<sup>6</sup> Since a role for money is defined in the first two phases, I disregard the third one.

<sup>7</sup> The presentation of Sidrauski (1967) and Svensson (1987) model, the latter for the case of CIA, draws heavily on Walsh (2010) and Jensen (2015).

time paths for consumption and real money balances subject to the following budget constraint expressed in per capita values

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

where  $y_t$  is the aggregate output,  $\tau_t$  is net transfers received from the government,  $k_{t-1}$  is the aggregate stock of capital at the start of period  $t$ ,  $\delta$  is the depreciation rate of physical capital, and  $\pi_t \equiv (P_t - P_{t-1})/P_{t-1}$  is inflation. For the sake of simplicity, it is assumed that the population growth is 0 and  $N_t = 1$ . The households' total available resources at period  $t$  denoted by  $\omega_t$  are:

$$\omega_t = c_t + k_t + m_t. \quad (3)$$

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

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

Equation (4) can be interpreted as the opportunity cost of holding money, which is positively related to the nominal interest rate  $i_t$ . Hence, it could be 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 could be extended both to study the steady-state equilibrium and to examine the dynamic behavior of the economy. Typically, this model also demonstrates the neutrality and superneutrality of money, thus providing us with conclusions on the impact of money growth on the economy. Likewise, the model permits us to analyze the welfare cost of inflation and to derive implications on the optimal quantity of money. Though this information is certainly valuable in understanding the workings of the macroeconomy and in guiding policy-making, it must be noted that from the outset money is simply presupposed in the system. In equation (1), money holdings are one of the arguments of the household's utility function. Agents derive utility directly from the very act of holding money. Unlike Walras' last monetary model, 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 just grafted in the utility function by appealing to a shortcut. This point is explicitly recognized by Walsh:

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 (Walsh 2010,52)

## 2.2 CIA

MIU is certainly not the only method to try to find 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 utilize money as an argument of the utility function. Instead, this author argued in favor of introducing a second constraint to the

utility maximization process. In this way, monetary theorists' analytical interests shifted from the utility function to choice alternatives described by the budget constraint. This is the route that was 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, he argued, 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, could be directly used in trade to acquire another. Thus, the model 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 his own words:

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 (Clower 1967, 3)

The solution 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 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 contained in Clower's aphorism: "Money buys goods and goods buy money; but goods do not buy goods" (Clower 1967, 5). 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). So, for example, Kohn (1981) assumes a household with two members: a worker and a shopper. The former spends the week working in a shop that produces a single good and gets paid for this labor at the end of the week. In contrast, the latter 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 the choice alternatives of the household.

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

$$\sum_{t=0}^{\infty} \beta^t u(c_t), \quad 0 < \beta < 1. \quad (5)$$

The maximization process is subject to a budget constraint  $\omega_t$  and a CIA constraint

$$\omega_t \equiv f(k_{t-1}) + \tau_t + (1 - \delta)k_{t-1} + \frac{m_{t-1} + (1 - i_{t-1})b_{t-1}}{1 + \pi_t} \quad (6)$$

$$= c_t + k_t + m_t + b_t, \quad (7)$$

where  $b_t$  stands for real bond holdings per capita. There are two types of markets: the asset and the goods market. If we suppose that the goods market opens first, then the CIA constraint on consumption goods is

$$c_t \leq \frac{m_{t-1}}{1+\pi_t} + \tau_t. \quad (8)$$

State variables that characterize individual agent's situation at time  $t$  are  $(\omega_t, m_{t-1})$ . For its part, the value function is

$$V(\omega_t, m_{t-1}) = \max_{c_t, k_t, b_t, m_t} \{u(c_t) + \beta V(\omega_{t+1}, m_t)\}, \quad (9)$$

maximization is over  $c_t, k_t, b_t, m_t$  subject to equations (7), (8) and the definition of  $\omega_{t+1}$ . Then, the first order conditions for consumption can be expressed as

$$u_c(c_t) = \lambda_t(1 + i_{t-1}). \quad (10)$$

A positive nominal interest rate raises the marginal cost of consumption above the marginal value of wealth. That is, the “price” of consumption is  $1 + i_{t-1}$  instead of 1 due to the need to hold money to finance a household's purchases. Consequently, for CIA, a positive nominal interest rate works as a consumption tax.<sup>8</sup>

In comparison with MIU, the CIA model can be regarded as a step forward. The latter does not suppose that the individual derives utility directly from holding money. Money yields utility indirectly through goods that agents can purchase with money. The CIA manages to depict the hallmark of the monetary economy, i.e., the fact that money is engaged in almost every market transaction. However, this step forward is not achieved by taking the hard and tricky road of 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 (8)) to ensure that it exhibits the differentiating trait of monetary exchange. Yet, it does not account for the underlying conditions that result in a role for money. So, for example, in CIA we lack an explicit formulation of reasons for which monetary exchange is decided by agents. Commenting on these limitations, Kiyotaki, Lagos, and Wright 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? (Kiyotaki, Lagos, and Wright 2016, 2)

### 3. A DICTUM FOR MONETARY THEORY: AN ONTOLOGICAL CRITERION TO CHOOSE BETWEEN RIVAL THEORIES

It has become a platitude to affirm that economists do not discuss the methodology of their discipline. Yet, upon closer examination, one can see examples that call into question such a charge. Neil Wallace is one of them. In a methodologically-oriented essay, Wallace (1998) 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” (Wallace 1998, 21; emphasis in the original).<sup>9</sup> In this section, I

<sup>8</sup> As in the case of MIU, we could keep developing the model to derive further practical implications about monetary policy.

<sup>9</sup> 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 has been widely cited by economists, I decided to keep the reference to this version.

argue that the monetary economists that dismissed MIU and CIA in favor of an alternative approach made this decision based on an ontological criterion. In support of this, I first defend the idea that Wallace's dictum can be interpreted as an appeal to build a foundational monetary theory, namely one that contains an ontology of monetary exchange. Later, I demonstrate that the Wallace dictum was indeed invoked by a group of monetarist economists to express their refusal of MIU and CIA.

For the economist who is familiar with modeling practices in monetary economics, the direct implication of dictum is surely clear. Nonetheless, if such training is lacking, its meaning might seem somewhat mysterious. Economists in their scientific practice build theoretical models from a set of assumptions and axioms whose validity is 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 other disciplines' scientific findings or simply from an observation of a real-world feature. Technologies, preferences, and endowments are often the primitives of a standard economic model. Once the primitives are set, the model is gradually built by exploring the interactions between variables.

A theory that forces the use of money through the imposition of restrictions and ad hoc assumptions is treating it as a *primitive*. Such a theory presupposes the use of money as a given building block of the system; however, it 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 section 3, we conclude that approaches taking shortcuts do not meet it. As noted above, MIU assumes that something called money is one of the arguments of utility function, whereas CIA imposes an additional constraint to find a role for money. Both approaches share a common flaw, however. They neglect the inquiry into the nature of monetary exchange and, consequently, if one is interested in discussing its foundations, MIU and CIA are non-starters. Neither of them accounts for the motives why individuals are willing to hold money. To put it bluntly, MIU and CIA cannot provide us with answers to fundamental issues about the monetary exchange. On these types of models, Kiyotaki and Wright (1989, 928) wrote "they have no hope of explaining endogenously either the nature of money or the development of monetary exchange."

Thus, Wallace's dictum implies that monetary theory has to be developed from a deeper level of analysis. It requires that theory starts clarifying the motives that lead individuals to decide to use monetary exchange as a transaction technology. Under the pressure of Wallace's dictum, monetary theory is pushed down one level, and monetarist economists are tasked with describing the fundamental conditions that make it possible for trade to take place with money. In section fourth, I will discuss in more detail the methodology and outcomes of this foundational monetary approach. For now, I note that as the use of money must be an outcome rather than an assumption of the theory, the descriptions employed to reach such a result yield valuable information on the nature of monetary exchange. Once the use of money is not treated as a given building block, monetary theory can improve our knowledge over one of the most stable and mysterious regularities of the market economy, i.e., human propensity to use money in trade. Regarding this theoretical challenge, Wallace 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 (Wallace 2001, 849).

As no other science will enlighten economics on the nature of monetary exchange, economists have to develop a monetary theory from a foundational level. Or to put in the terms of the macroeconomist Thomas Sargent (2015) “Wallace thinks monetary economics is important and that we should be patient enough to construct a monetary theory from *first principles*” (Sargent 2015, 49; emphasis added). In line with the above, this call along with its implications to build a monetary theory from *first principles* justifies that Wallace’s dictum can be interpreted as an ontological dictum for money. Monetary theory must become a source of information about the ontology of monetary exchange.

Now we can turn to the role played by the Wallace dictum in disregarding non-foundational monetary theories. While it is true that Wallace’s dictum is a useful analytical tool for classifying monetary theories in accordance with their ontological properties, it also entails a normative criterion to distinguish between good and bad theory. Although Wallace (1998) is not explicit in saying this, underlying his dictum is the idea that good monetary theory is one that satisfies this dictum. He states, “I will take this opportunity to propose and defend a dictum, or rule, that *monetary theory ought to satisfy*” (Wallace 1998, 21; emphasis added). This normative character of his dictum is reinforced toward the end of his essay as well. Wallace notes that models that satisfied the dictum opened new questions, which arise from generalizations and modifications of initial assumptions. On this, he concludes “[p]rogress in monetary theory will be made by asking and pursuing the answers to such questions” (Wallace, 1998). For him, therefore, scientific progress in monetary theory is achieved by accepting his dictum as one of the basic principles of monetary modeling.

In short, Wallace’s dictum established a criterion for normatively judging existing monetary theories according to their ability to inform about the nature of monetary exchange. Nevertheless, once the rule was set and accepted by at least a significant group of practitioners, its repercussions went further. The dictum ended up being viewed as an attribute that some theories possessed and which others lacked. And since the attribute is regarded as part of the characteristics of a good theory, it turned the dictum into a choice criterion between rival monetary theories. More specifically, a group of monetary economists discarded MIU and CIA invoking as an argument that they did not satisfy Wallace’s dictum.

Nowadays, this group introduces itself as representing a novel monetary school so-called *New Monetarist Economics* (NME). For NME’s members, the reference to the Wallace dictum is not intended to justify a circumstantial modeling preference, but instead to signal a distinguishing feature of their school. NME embraced the Wallace dictum to the point of elevating it to the rank of a guiding principle. In contrast to what is accepted in MIU and CIA, New Monetarists work on deciphering both the functioning and the nature of monetary phenomena through models that generate an endogenous money demand. Williamson and Wright (2010, 2011), two leading NME members, identified five principles that serve to distinguish a New Monetarist from an Old Monetarist and a New Keynesian economist. 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 2010, 267; emphasis in the original).

Of course, the logical consequence of establishing this key principle is foreseeable. Models employing shortcuts for money had to be rejected in favor of theories in which the use of money is not presupposed. And this was exactly what New Monetarists did. This principle marked a crucial difference among their own theoretical preferences and those practices accepted by monetary economists working with shortcuts. Monetary policy models that impose CIA constraints, or utilize MIU, or that simply have no money clearly violated the Wallace dictum and therefore had to be refused. So, for example, Nosal and Rocheteau (2011) vindicated their refusal of MIU and CIA in terms of the non-satisfaction of Wallace's dictum "[f]ollowing 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" (Nosal and Rocheteau 2011, 4).

Furthermore, to the extent that NME developed a family of monetary models with several generations and accumulated results that could be confronted with those generated by competing approaches, the dictum was also used to emphasize a positive property of their account. That is, the dictum was employed to highlight a positively-judged property of the New Monetarist account. 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, Rocheteau, and Wright 2017, 375). Accordingly, the Wallace dictum was not merely invoked to discard rival theories but also did its part in strengthening the development of a new modeling preference.

#### 4. TOWARD AN ONTOLOGY OF MONETARY EXCHANGE

So far I have argued that a group of monetarist economists made their theory choice based on an ontological criterion. To strengthen the argument, I claimed that the Wallace dictum, which was accepted by NME, can be interpreted as a call to develop a foundational monetary theory. In this section, I synthesize the path followed by New Monetarists to build such a foundational theory. After, I briefly mention some characteristics of the ontology of monetary exchange and money resulting from this approach.

Hahn (1973) pointed out another flaw in general equilibrium models, in addition to the aforementioned positivity problem. For him, money played no essential role in these 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" (Hahn 1973, 231). 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. Thus, these models, in showing an essential role for money, could not only demonstrate the superiority of monetary exchange but also elucidate the reasons as to why the agents decide to use money.<sup>10</sup>

The essentiality of money was mainly investigated through frictions (Wallace 2001, 2008). The Arrow-Debreu model depicts a centralized exchange mechanism and, consequently lacks a description of the exchange process among agents. In a competitive equilibrium of a frictionless economy, although deliveries occur after the fact, 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. Therefore, New Monetarists developed models that, on the one hand, describe

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<sup>10</sup> For Álvarez and Bignon (2013) the essentialist perspective can be viewed as opposed to the project of integrating value and money theory. To this respect, after a long wait, monetary theory finally seemed to stop being the weak partner of the Walrasian price theory, thereby acquiring its own scientific status.

explicitly who trades with whom and how, and on the other hand contain frictions—i.e., factors or circumstances that inhibit trade between agents—which money helps overcome. Since money contributes to remedying these frictions, agents are allowed to accomplish economic outcomes that would be unavailable in money’s absence. This essential characteristic makes individuals decide to use money in trade, and thus there is no need to impose a role for it. In other words, models of essential money do satisfy the Wallace dictum. Not surprisingly, he embraced this perspective, “I think most economists want to have models of money in which it is essential. Otherwise, why bother with money?” (Wallace 2001, 849).

Kiyotaki and Wright (KW) (1989) succeeded in creating a model that employs search theory to represent an endogenous role for money with the characteristics mentioned above; this was later refined for fiat money (1991, 1993). In this model, 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. Thus, agents might decide to use money to overcome the double coincidence of wants problem. This was the main outcome arising from the KW model. However, further research showed that the absence of double coincidence of wants was not sufficient to render money essential (Kocherlakota, 1998). Other frictions had to be considered, especially those limiting the use of credit.

For the sake of clarity, the role of these additional frictions can be introduced by drawing on Lagos, Rocheteau, and Wright (2017). Consider a situation in which agents specialize in the production of distinct goods, at cost  $c > 0$ . Such goods are non-storable and are produced for immediate consumption. The probability of meeting anyone is  $\alpha$ , and when agents  $i$  and  $j$  meet the probability of a single coincidence is  $\sigma$  and the probability of a double coincidence is  $\delta$ . If an agent consumes the good she likes, it yields a utility  $u > c$ . For any other good, its consumption yields  $u = 0$ . There is a fixed fiat money supply  $A \in [0,1]$  and each agent can hold at most one unit, which is indivisible.

Assuming  $A = 0$ , agents can stay in autarky and the payoff is  $V^A = 0$ . They also can choose a barter exchange, in which case the flow barter payoff is  $rV^B = \alpha\delta(u - c)$ . Given  $\delta > 0$ ,  $V^B > V^A$ . As stated above, under a barter system in some meetings  $i$  wants to trade but  $j$  does not. To solve this problem, one could consider a pure credit system in which agents produce for another without receiving anything in return only because they believe in a promise that someone in the future will do the same for them. The flow credit payoff is  $rV^C = \alpha(\delta + \sigma)(u - c)$ , therefore if  $\sigma > 0$  then  $V^C > V^B$ . Thus, the economy works best when based on a cooperative behavior that is expressed through a pure credit system. That is, if agents commit ex ante to deliver the promise of producing without a *quid pro quo* trade, the use of money would be unessential.

Now, suppose that agents cannot commit. We must then compare the payoff of keeping the promise ( $V^C$ ) with the deviation payoff ( $V^D$ ). Agents deliver the promise whether this incentive condition (IC) is met:

$$-c + V^C \geq \mu V^D + (1 - \mu)V^C. \quad (11)$$

Where  $\mu$  denotes the probability of a deviator being caught and punished. If  $\mu < 1$ , deviators are only probabilistically caught as the monitoring is imperfect. If there is no monitoring ( $\mu = 0$ ), everybody has an incentive to cheat. However, under the assumption of imperfect monitoring ( $0 < \mu < 1$ ), we need to consider  $V^D$ . When a deviator is caught, she receives

$V^D = V^B$ , i.e., she is excluded from the pure credit system. In such a case, equation (33) holds iff

$$r \leq \hat{r}_C \equiv \mu\alpha\sigma(u - c)/c. \quad (12)$$

We can now examine the case of money ( $A > 0$ ). Once the value function for agents are defined, the best response conditions for a monetary equilibrium to exist can be reduced to the following:

$$r \leq \hat{r}_M \equiv \alpha\sigma(1 - A)(u - c)/c. \quad (13)$$

Money is only used when  $\hat{r}_M > \hat{r}_C$ , which requires that  $\mu < 1 - A$ . Remarkably, this implies that if the monitoring is perfect ( $\mu = 1$ ) money becomes unessential. The economy works better under a pure credit system with perfect monitoring than it does with money. Thus, to make money essential, at least two more frictions must be considered in addition to the double coincidence of wants problem. First, agents cannot commit ex ante to a pure credit economy, and second agents must trade in a context of imperfect monitoring.

Unlike MIU and CIA, which cannot address fundamental issues on monetary exchange, New Monetarists derived new insight about its nature. The frictions mentioned above form some of the fundamental reasons that give rise to the monetary exchange. We find that specialization in the production of goods and services makes barter an inconvenient exchange technology. In addition, a market economy is also characterized by the participation of multiple and diverse agents that are strangers, although they interact among themselves. The anonymity of agents makes it more difficult for them to commit to a pure credit system either based on cooperation or punishment. Therefore, agents decide to use money as a mechanism to benefit from trade while overcoming frictions such as specialization, commitment, and imperfect monitoring, all of which inhibit the operation of alternative transaction technologies.

I briefly now demonstrate that this account of the nature of monetary exchange also provides us with information on the ontology of money. Traditionally, economists have described money as a medium of exchange, a store of value, or a unit of account. Nonetheless, the essentialist project uncovered another foundational property of money in the nature of monetary exchange. As Kocherlakota (1998) emphasized, under a pure credit system each agent can be thought of as keeping an imaginary balance sheet. Thus, when one agent produces something for someone else, his/her balance increases, as well as his/her access to future transfers. In contrast, when an individual consumes something produced by someone else, it reduces his/her balance and limits his/her reception of future transfers. However, when a society lacks commitment and has imperfect monitoring, it is hard to know whether an individual is running a deficit or surplus. Money therefore is used to keep track of past actions and transactions. Although Juan does not like Pedro's music, he produces coffee for Pedro as he expects that Gabriel, who hates coffee, will give up his latest novel for nothing in exchange. The problem arises when Gabriel does not know if Juan produced for Pedro in the past. This issue is solved if Juan shows Gabriel the money he got from Pedro to prove that he did indeed produce. With this in mind, we can see now that money is a record-keeping device of past transactions. Aside from the three standard functions, another foundational property of money's ontology is to be a device that mitigates the information limitations by providing a record of the past histories of trading partners.

By introducing frictions in settings that describe a decentralized exchange process, this foundational approach could prove the essentiality of money, thereby extending our knowledge about the ontology of monetary exchange and money. In a balance of this approach, Lagos wrote:

This approach has deepened our understanding of the nature of monetary exchange by making explicit the frictions [...] that make monetary exchange an equilibrium. In other words, this approach has proven useful for explaining the grandfather of all asset pricing puzzles: the existence of fiat money (Lagos, 2008).

## 5. CONCLUSIONS

This paper seeks to make a contribution to the study of theory choice in economics. It investigates a choice criterion other than empirical and social criteria. Particularly, it explores the ontological criteria and proposes that economists faced with rival theories might choose the one that informs over the ontology of its subject matter. The role played by the Wallace dictum in monetary economics is shown as evidence in support of this claim. I argue that such a dictum can be interpreted as a call to develop a foundational theory of monetary exchange. Since the satisfaction of the dictum is regarded as a property of a good theory, it has become a choice criterion among competing approaches. However, a further implication can be derived from this result. If economists build models to investigate the nature of certain social entities, that scientific work allows us to gain insight into the ontology of the social world. Paradoxically, although money is one of the favorite study cases of social ontology theorists, this foundational monetary theory is often either simply ignored or just superficially revised. Searle's account of institutions is representative of this careless attitude toward monetary economics. This is a pity, among other reasons, because as I claimed earlier economists have not had an easy time figuring out the nature of monetary exchange and money. Though there has been some recent progress in this area, many substantial issues are not yet settled. Consequently, economists might find it useful a philosophical work that starting from a sound understanding of monetary theory can point out mistaken presuppositions and/or suggest new alternatives.

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