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Piet-Hein Van Eeghen

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Rethinking Equilibrium Conditions in Macro-Monetary Theory: A Conceptually Rigorous Approach

Piet-Hein van Eeghen[*]

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Abstract

Although still very much a minority view, there is a growing sense of unease about the high degree of abstraction involved in contemporary macro-monetary theory, in particular concerning its representative-agent microfoundation (see e.g. Colander et al., 2008; Goodhart, 2005, 2008; Buiter, 2009; Caballero, 2010; Hoover, 2010; Du Plessis, 2010; Meeusen, 2010). The paper shares this unease but questions another aspect of contemporary theory: its equilibrium conditions as consisting of its market coordination conditions and budget equation. The paper derives, from scratch, an alternative set of such conditions which it rigorously grounds in the nature of monetary exchange. This alternative set has implications for a wide variety of issues, including the aptness of MIU and CIA modelling, the nature of real and monetary disturbances, and the linkage between the financial and real sectors. The paper also assesses the conceptual soundness of commonly used constructs like Keynes's income-spending (saving-investment) equation of IS analysis, Hicks's wealth constraint, Fisher's quantity equation, Walras's Law, and the budget constraint of contemporary DSGE modelling.

Keywords: monetary exchange, equilibrium condition, budget equation, market coordination, market price.

JEL codes: E02, E11, E12, E40

1 Introduction

Equilibrium conditions come in two basic forms. First, they figure as conditions for optimising behaviour and, second, they function as conditions for plan coordination stated as demand-supply equalities. The paper strictly separates these two types of equilibrium condition and concerns itself exclusively with demand-supply equalities, in which it includes budget equations. Taken on their own, such equilibrium conditions have no necessary connection with optimising behaviour or any behavioural explanation for that matter. Instead, they identify the particular demand and supply plans by which coordination in market exchange (offers to supply = offers to demand) and coordination in funding (supply of liquidity = demand for liquidity) are defined and interlinked.

In addition to coordination levels, price levels are also determined via the demand and supply plans featuring in equilibrium conditions. For instance, Fisher (1926) and Keynes (1930) posit that the general price level is determined via the terms of the quantity equation and the Fundamental Equations respectively. More recently fiscal theorists of the price level (e.g. Sims, 1994; Woodford,

1996; Cochrane, 1998, 2005) maintain that the general price level is established via the terms of a government budget equation. Robertson (1926, 1940) and Keynes (1936) likewise base their competing interest rate theories on equilibrium conditions which list the demand and supply components in what they consider to be the relevant market. Obviously, just as the failure of an equilibrium condition would spell change in the relevant price, its satisfaction suggests price stability.

In themselves, separate from any behavioural explanation, equilibrium conditions evidently cannot tell us anything about the likelihood of their satisfaction and, hence, about the likelihood of coordinative success and price stability. Even so, they help us gauge that likelihood by pointing towards the behaviour categories (the demand and supply plans) potentially of influence on price and coordination levels. A defectively specified set of equilibrium conditions is misleading precisely because it gives wrong or incomplete information in this regard. The descriptive value of theory is, therefore, to an important degree determined by how correctly its equilibrium conditions are specified; that is, whether the appropriate demand and supply items feature in them. As Clower (1967, p. 203) notes about the budget equation in particular: "The factual content of theory depends very largely ... on [the] restrictions implicit in the budget equations. Accordingly, the main question that we have to answer in order to appraise the empirical significance of contemporary monetary theory is: "Do the budget equations ... constitute an appropriate definition of choice alternatives in a money economy?"" If Clower is right, the quest for an empirically based macro-monetary theory does not only lie in rethinking its modes of explaining behaviour (its microfoundations) as suggested by Colander et al. (2008), Hoover (2010), and Meeusen (2010), but also in rethinking the specification of its equilibrium conditions.

The early modern macroeconomics of Wicksell, Fisher, Lindahl, Keynes and Robertson was, of course, vitally concerned with equilibrium conditions, its formal theoretical constructs consisting of little else besides saving-investment equalities, quantity equations, Fundamental Equations, budget equations, and the like. The subsequent generation of Hicks (1946) and Patinkin (1965) was no less focused on equilibrium conditions, but had a particular, more narrowly theoretical objective, which was to recast preceding macro-monetary thought in a Walrasian general equilibrium mould. This research project invited critical reaction from a number of authors, chief amongst whom were Clower (1965, 1967, 1971), Clower and Leijonhufvud (1975a, 1975b), Tsiang (1966, 1980) and Kohn (1981a, 1981b, 1988), whose approach came to be known as the finance constraint approach (Kohn, 1988). These authors felt that the equilibrium conditions of Walrasian analysis, in particular its budget equation, violated the essentials of monetary exchange and could, therefore, not do justice to preceding monetary thought, be it classical, Wicksellian or Keynesian.

Needless to say, with the exception of Lucas's (1980) cash in advance (CIA) constraint which took its cue from Clower (1965), the finance constraint literature largely failed to make a lasting impression on mainstream thought. Part of this failure may be attributable to lack of persuasiveness, but part of it can also be ascribed to its underlying objective, which was rigorously to ground equilibrium conditions in the technology of monetary exchange. This objective was, and continues to be, radically at odds with the prevailing methodological outlook which rates analytical rigour above conceptual rigour and which, consequently, tends to be strictly principled about process and technique but more readily pragmatic about content and relevance (Goodhart, 2005, 2009; Caballero, 2010). Interestingly, the recent surge in popularity of New Keynesian dynamic stochastic general equilibrium (DSGE) models "with their ... careful attention to budget constraints and equilibrium conditions" (Walsh, 2005, p.463) has aroused renewed interest in equilibrium conditions. Not that this "careful attention" has in any way produced a greater concern for conceptual correctness. Quite the contrary. The equilibrium conditions (including the budget constraints) of DSGE models are more detailed and meticulously constructed than they have ever been, but they are also conceptually more contrived and hallow than they have ever been, as the paper hopes to show.

While the paper reaches conclusions which are significantly at odds with the finance constraint literature, its objectives are broadly the same: (a) to discover what a set of equilibrium conditions should ideally look like if it conformed rigorously to the nature of monetary exchange and (b) to

assess the equilibrium conditions of established macro-monetary theory in the light of that ideal set. Because it focuses on equilibrium conditions as coordination requirements and disregards behavioural explanation, the paper ignores the complex of optimising conditions of conventional theory, thereby stripping it from almost all its sophisticated analytical adornment and reducing it to a relatively simple core which can be assessed with the aid of conceptual, qualitative logic only. The paper frequently engages with an older literature simply because that is where most of the accumulated wisdom on its topic is to be found. The last couple of decades have just not produced much that is helpful in constructing a conceptually sound set of equilibrium conditions. The paper may thus appear somewhat "retro" in parts.

Section 2 briefly establishes two fundamentals of exchange, which underlie the whole paper and also shape its logical build-up. That logical build-up can, therefore, only sensibly be discussed at the close of section 2.

2   Fundamentals of exchange: money and moment

Our first fundamental is to claim that money functions, first and foremost, as generally accepted medium of exchange (Clower, 1967; Kiyotaki and Wright, 1989; Ostroy and Starr, 1990; Laidler, 1997; Thornton, 2000; McCallum, 2003). All our equilibrium conditions are premised on that understanding of money. There is no space for a detailed defence here, but two brief remarks are in order. First, the claimed money definition does not seek to take anything away from the relevance and importance of the other traditional money functions, but does suggest that these are secondary and derivative. Second, the definition does not imply anything about the historical development of money and should leave considerable freedom in addressing that issue. It need not, for instance, take sides in the Mengerism versus Chartalism controversy as Goodhart (1998) calls it. The assumed general acceptability of money can be based on a voluntary private consensus or it can be enforced by law, which does not matter for our analysis.

Our second fundamental of exchange is as vital as it is generally neglected. It asserts that exchange is momentary: commodities change hands at something close to a point in time (Myrdal, 1939, pp.43-45; Clower, 1965, p. 106n; Harrison, 1980, p. 113; Snippe, 1987). This idea is not contradicted by Greig's (1997, pp. 247-248) claim that "exchange is always sequential, namely, some time elapses between the *quid* and the *quo*". It merely posits that both the *quid* and the *quo* in exchange are attached to moments, not that these moments necessarily coincide (spot trade). Greig's (1997, 2000) institutional-historical analysis insists on the sequentiality of exchange in order to accentuate the risk inherent in future delivery, which is not a consideration in our analysis. Because it largely focuses on money movements, our analysis has no need to assume spot trade.

The main analytical implication of our second fundamental is that transacted amounts should be treated as momentary stocks, which runs counter to the convention of regarding them as periodic flows. This convention can be traced back to Fisher (1906) who unwittingly employed two different, potentially inconsistent, stock-flow distinctions. The first is between a stock as something that happens at a moment and a flow as something that occurs over a period. For obvious semantic reasons, however, a stock can also be understood as an inventory of things, with a flow then referring to a change in such inventory. According to this second distinction, for instance, wealth and capital are stocks while income and investment are flows. When these two stock-flow distinctions get superimposed on each other, wealth and capital have to be treated as momentary stocks, and transactions like income and investment necessarily become periodic flows. But income and investment can evidently also be stocks in the momentary sense, referring to the moment the income was received and the moment the spending on investment goods took place.

Furthermore, this moment's quantity supplied cannot be acquired or produced at that same moment, so must come out of an inventory of goods acquired or produced in the past. In the same way, this moment's quantity demanded cannot simultaneously be used, so must be put in inventory

(for a short or long time) until the time of future consumptive or productive usage. The approach in conventional price theory to identify supply with production and demand with consumption is unfortunate, because it is narrowly applicable to unstockable services only. For stockable material goods, production is never immediately supplied but first put in stock, just as consumption is never immediately demanded but first taken out of stock. The conclusion is that demand and supply plans are equivalent to inventory changes, which are thus momentary too. This conclusion has important implications for both value theory and macro-monetary theory.

To appreciate the implication for value theory, the obvious fact should first be noted that the price of a good and the degree of plan coordination attained in its market can be influenced only via intended transactions: offers to demand or supply the good in question (Snippe, 1985a, 1985b, 1987). Only demand and supply plans should, therefore, feature in the market equilibrium conditions of non-monetary goods, broadly understood as including assets. This focus on transacted amounts does not imply that the influence of inventories on price and coordination levels is ignored, as mistakenly suggested by Sexton et al. (1992). After all, transactions *are* inventory changes, whereby it does not matter whether the transacted goods came out of "new" or "old" inventory as long as they were qualitatively the same. Hence inventory equilibrium (actual inventory = desired inventory) is already implicit in market equilibrium (offers to demand = offers to supply), and theories of market price and market coordination do not need to consider the former in addition to the latter. As Hicks (1965, p. 85) similarly remarks: "As long as we hold to the principle of price determination by 'equilibrium of demand and supply', ... we have no call to attend to anything but transactions. We do not need to distinguish between stocks and flows."[1] Had theorists treated transactions as momentary, the entire stock-flow muddle, which has particularly bedevilled interest rate theory (see Snippe, 1985a), could, perhaps, have been avoided.

The situation for money is reversed. By virtue of being exchangeable for all goods, money does not have its own market and therefore does not require its own market equilibrium condition. Money's market equilibrium is already implicit in the market equilibria of all the goods against which it is traded. But money does require its own inventory equilibrium, which is *not* implicit in these goods market equilibria. Money's inventory equilibrium condition must, by nature, take the form of a monetary budget equation, which can be expressed in various equivalent ways. The simplest is that of Keynes's (1936) money market equilibrium, which specifies the actual money stock-as-inventory and the demands that are made on that stock for the purpose of financing both planned money spending and continued planned money holding.

The money stock is, in fact, the only inventory variable of relevance to macro-monetary analysis. Inventories of non-monetary goods can be ignored, because they impact on transactions in just their own market, the effect of which is already captured by the market equilibrium conditions of the relevant goods – as noted above. Non-monetary wealth effects take on macroeconomic significance only insofar as they influence the scarcity of money, that is, via their impact on the terms of the monetary budget equation. As will be seen in section 5 below, this has important implications for the way in which wealth or price effects are presumed to influence aggregate spending levels. Portfolio theory's wealth constraint manages to confer multi-market significance on inventories of non-monetary goods by allowing them to be directly bartered for each other – a decidedly awkward strategy if the analysis otherwise seeks to describe monetary exchange.

Why then was the wealth constraint introduced into monetary theory at all? A careful reading of Hicks (1935, p.4ff) appears to suggest he did so to resolve a particular logical dilemma faced by conventional period analysis, which concerns the awkwardness of allowing direct causal interaction between a momentary stock of money and periodic transaction flows. To ensure that stock interacts only with stock, and flow only with flow, Hicks implied that the money stock feature just in momen-

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[1] Confusingly, the supply and demand labels are also employed in inventory equilibrium conditions. For instance, the "supply" of money is used to describe its actual inventory and the "demand" for money its desired inventory, neither of which is a supply or a demand in the plain sense of an offer to exchange. Because this confusing labelling is already so entrenched, the paper sticks with it. One chooses one's battles.

tary portfolio analysis and transaction flows just in periodic income-spending analysis. Accordingly monetary analysis came to be conducted with the aid of a pure inventory equilibrium condition (the momentary wealth constraint) and real analysis with reference to a pure market-transaction equilibrium condition (the periodic income-spending equality). Interaction between the monetary and real spheres was permitted only indirectly, through changes in the interest rate, which has remained the convention in macroeconomic theorising since Keynes (1936) even when no use is made of portfolio analysis in the determination of the interest rate, as in the case of New Keynesian DSGE modelling.

However, once it is realised that transactions are momentary, Hicks's original logical dilemma disappears and thus also the need to circumvent it by segregating inventories from transactions: the monetary budget equation can render both its money transactions and its money inventory as stocks in the momentary sense. Monetary and real analysis can then be reintegrated through a momentary-monetary budget equation, as Snippe (1985b) shows with the aid of a Robertson-type budget equation. While this budget equation gives all its variables as momentary stocks, it does not attach them all to the *same* moment. Momentary analysis does not imply static analysis. In fact, momentary analysis is more conducive to the proper treatment of dynamic change, because change is better captured by the comparison between moments than between periods, as was already noted by Myrdal (1939, pp.43-45).

The three broad types of equilibrium condition required by an integrated monetary and real analysis can now be identified: 1. a set of individual goods market equilibrium conditions, 2. a monetary budget equation, and 3. a securities market equilibrium condition via whose terms the general interest rate is to be determined. Considerations of space preclude us from discussing the third equilibrium condition here, which means that interest rate theory will largely be left unattended.

The agenda for the coming sections is now set. Section 3 establishes a set of individual goods market equilibrium conditions, which it breaks down into a macroeconomic condition expressed in aggregate nominal terms, and a collection of microeconomic conditions given in individual-market real terms. Section 3 also explores the implications of this break-down for price and output determination. Section 4 derives a monetary budget equation, first in a Keynesian static form and then in a Robertsonian dynamic form portraying the circular income-spending stream with monetary injections and leakages. In the process of deriving these budget equations, section 4 comments on the appropriateness of money-in-the-utility-function (MIU) and cash-in-advance (CIA) modelling. Section 5 uses the much neglected Robertsonian budget equation to shed light on the nature of monetary disturbances, the transmission between money and spending, and the linkage between the financial system and the real sector. Lastly, section 6 assesses the conceptual soundness of some of the more widely used equilibrium conditions in macro-monetary theory: the Keynesian goods market equilibrium condition of IS curve analysis, the quantity equation, the original Walrasian budget equation typical of Patinkin-style macroeconomics (Walras's Law), and the dynamic budget constraint of more contemporary DSGE modelling.

3   Plan coordination in the goods market

We start with the most basic and obvious requirement for overall goods market coordination:

$$y_t^s = y_t^d \text{ for each goods market } y \ (y = 1, \ 2, \ ..., \ n) \tag{1}$$

y_t^s and y_t^d denote planned real quantities supplied and demanded for each market in goods set y ($y = 1, 2, \ldots, n$) at the current moment t. Set of equations 1 is very similar to the market coordination conditions of Walrasian general equilibrium economics with one important difference. Although set y is to be understood as comprising all categories of goods, including intermediary and non-recently produced goods, it does not contain all individual goods on offer and its composition is open to continual change. The totality of all goods cannot, after all, be traded at every single

trading moment. Interestingly, Clower and Leijonhufvud (1975a: 183-184) argue that the generalised Arrow-Debreu model violates Walras's original intent in precisely this respect: "Walras regarded his work as an attempt partially to characterise equilibrium states of an ongoing economic system. To suppose that Walras conceived his analysis to constitute a complete description ... of relevant equilibrium conditions would be an egregious error." Dealing in real quantities, equation set 1 suffices as a description of the coordination requirements for barter exchange.

As a first step in uncovering the additional coordination requirements posed by monetary exchange, we identify its characteristic attribute. In accordance with money's primary function as generally accepted medium of exchange, monetary exchange can be typified by the equivalence between supplying goods and demanding money as well as between demanding goods and supplying money (c.f. Clower, 1967). In symbols:

$$P^y y_t^s \equiv ME_t^d \tag{2}$$

$$P^y y_t^d \equiv ME_t^s \tag{3}$$

ME_t^d and ME_t^s signify the money demanded or supplied in exchange for good y at the current moment t. ME, short for Money in Exchange, denotes the active money balances to be distinguished from the passive money inventory for which the conventional symbol M will be used. While M is a stock-as-inventory and ME a flow-as-change-in-inventory (a transaction), both are stocks in the momentary sense by virtue of the momentary nature of exchange. Nominal goods prices, P^y, make their appearance for the obvious reason that equations 2 and 3 now record amounts of money.

Equations 2 and 3 are specimens of a larger genus called *equation of exchange,* which is neither a market coordination condition nor a budget equation but an expression of the *quid pro quo* in exchange (for a useful historical overview, see Fayazmanesh, 2006)[2]. These equations allow us alternatively to write equation set 1 as:

$$ME_t^d = ME_t^s \text{ for each goods market } y \ (y \ = \ 1, \ 2, \ \ldots, \ n) \tag{4}$$

What equation set 4 adds to equation set 1 is the requirement that the amount of money which demanders offer in exchange for good y be equal to the amount of money which suppliers are willing to accept in exchange for good y. In a monetary exchange economy, market coordination requires not only that the physical quantities demanded and supplied match (equation set 1), but also that the transaction balances needed to finance the exchanges are sufficient (equation set 4). The coordination requirements inherent in equation sets 1 and 4 can be condensed into a single equation set stipulating the equality between nominal notional supply and nominal effective demand in each goods market y:

$$P^y y_t^s = \mathbf{P}^y \mathbf{y}_t^d \text{ for each goods market } y \ (y \ = \ 1, \ 2, \ \ldots, \ n) \tag{5}$$

Effective demand, written in **bold** and non-cursive, is demand which is both planned (notional) and supported by sufficient monetary finance (Clower, 1965). As such, it is equivalent to actual spending. With equation set 5 we have arrived at the overall goods market equilibrium condition for a monetary economy. The equation set underscores the commonsense notion that money touches the goods market on its demand side, by facilitating or constraining planned demand.

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[2] The fact that equations of exchange appear – or ought to appear – in pairs (one for each side of the exchange) suggests that they do not indicate actual exchanges but merely the unilateral exchange plans of demanders and suppliers separately and independently. This dispels the common misconceptions, still present in Clower (1967), Clower and Leijonhufvud (1975a) and Fayazmanesh (2006), that equations of exchange presuppose spot trade and that they rule out theft, charity or bargaining power imbalances. It also exposes the inappropriateness of Clower's (1967) attempt to capture the *quid pro quo* in monetary exchange by way of a "matrix of exchange" involving the bilateral exchange plans of both demanders and suppliers. Such matrices, which have been further developed by Ostroy and Starr (1974) and more recently Fayazmanesh (2006), needlessly complicate what the medium-of-exchange function of money is about.

Our next step is to establish the rationale for the aggregate, macroeconomic perspective. This rationale follows, again, from money's status as generally accepted medium of exchange: "Because money ... is the one thing routinely exchanged against all sorts of things, an excess supply or demand for it does not appear on any particular market or in connection with any particular disequilibrium price... [Rather it] shows up ... as a generalised frustration in earning incomes" (Yeager, 1968, p.62). Given that money touches the goods market on its demand side, Yeager's point can be restated more generally like this: changes in aggregate goods spending must be accompanied by changes in the scarcity of money. This restatement deliberately leaves open whether the causal direction runs from money to spending or the other way around. No business cycle theory should be inferred from it. The various components of the demand and supply of money capable of causing a change in its scarcity can only be identified with the aid of a monetary budget equation, which will be derived in the next section.

A change in the scarcity of money, say an increase in the money stock, tends to be initially localised, confined to only some sectors and markets. But because money continually circulates, this localised change eventually turns into a generalised change felt more or less equally across all markets and sectors, provided it is large enough and does not get neutralised by opposite change elsewhere in the economy. We initially focus our attention on generalised changes in the scarcity of money and their effect on aggregate effective demand. In so doing, we temporarily abstract from the generalisation process and the possible disequilibrating influence which changes in the scarcity of money may have on the proportional distribution of aggregate demand over individual goods markets (disproportionalities).

Neutral money is Hayek's label for a Wicksellian idea (Patinkin and Steiger, 1989; Visser, 2002), which, if we abstract from disproportionalities, may sufficiently be described by the attainment of aggregate goods market clearing:

$$\sum P^y y_t^s = \sum \mathbf{P}^y \mathbf{y}_t^d \tag{6}$$

Accordingly money is non-neutral when the aggregate goods market fails. A monetary disturbance can then be defined as a generalised change in the scarcity of money which accompanies a movement in aggregate spending away from aggregate supply. The more specific nature of monetary disturbances can, once again, be established only after having derived a monetary budget equation. Equation 6 is what we will refer to as the *macroeconomic equilibrium condition*, which aggregates over all goods y traded at moment t within a given economy[3]. We take it for granted that $\sum P^y y_t^s$ refers to planned aggregate supply at full capacity utilisation.

Say's Law asserts that money is neutral in Wicksell's sense, but only roughly and approximately so. The classical supporters of Say's Law did not claim the absence of monetary disturbances, but rather that these are either fairly small and transient or, when larger and more persistent, attributable to exceptional circumstances like wars, banking crises or the discovery of large deposits of monetary precious metal (Sowell, 1972; Niehans, 1987). Hence Say's Law does not refer to the short-term satisfaction of macroeconomic equilibrium as implied by Keynes (1936), even less that equation 6 can be written as an identity as claimed by Lange (1942) and Patinkin (1965), and still insisted upon by Handa (2009) (see also Baumol, 1977, 1999). The Quantity Theory's concept of neutral money is of a subtly different nature, asserting that these larger and more persistent monetary disturbances, for which Say's Law allows by way of an exceptional circumstance, have no long-term real effects because being neutralised by changes in the general price level. Patinkin and Steiger (1989), Lucas (1996) and Patinkin (2008) strangely conflate these two meanings of money neutrality, defining it in Quantity Theoretical terms but implying that it somehow incorporates Say's Law (macroeconomic equilibrium) too.

The introduction of the macroeconomic equilibrium condition of equation 6 entails a useful convenience. Equilibrium condition set 1 applicable to barter can be maintained for a monetary economy

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[3]Money neutrality is also commonly referred to as monetary equilibrium (see e.g. Myrdal, 1939), which is a term we will, however, reserve to convey a different meaning to be introduced in the next section.

as the requirement that the real compositions of aggregate demand and supply are matching: no disproportionalities[4]. We can rename it the *microeconomic equilibrium condition*. Overall goods market equilibrium (equation set 5) can then be broken down into microeconomic equilibrium (equation set 1) and macroeconomic equilibrium (equation 6). Microeconomic equilibrium expresses the absence or resolution of real disturbances in the form of changes in tastes, technologies and resources, while macroeconomic equilibrium signifies the absence or resolution of monetary disturbances in forms still to be identified in section 5 below.

This breakdown should not be taken to mean that real disturbances cannot cause macroeconomic disequilibrium (in- or oversufficient aggregate demand) but rather that they cannot cause macroeconomic disequilibrium unless they also generate monetary disturbances, as they often do – especially in a fiat money world with its more accommodative money stock. Such is the basic proposition of Yeager's (1986, 1997) *monetary disequilibrium* approach, which yields the useful insight that real disturbances in themselves can bring about only "misallocation waste" but no "idleness waste" unless they spawn monetary disturbances too. In a monetary economy, idleness waste (an output gap) cannot happen without a monetary disturbance, even if that disturbance need not have been the initial, prime mover. Conversely, monetary disturbances may also generate real disturbances as a secondary effect, such as when a financial-crisis induced contraction lowers the appetite for risk which will hit the investment goods market disproportionately hard (Hall, 2010). Generalised monetary disturbances may thus, via their secondary real effects, cause disproportionalities too.

One should, of course, be careful not to apply Yeager's insight to the labour market in particular. Idleness waste in the labour market (unemployment) cannot only be attributed to monetary disturbances. When macroeconomic equilibrium is obtained and production capacity is fully utilised, that production capacity itself may still be insufficient to take up the entire labour force due to a lack of appropriate material inputs, know-how, entrepreneurship and infrastructure – physical as well as institutional. Keynes (1936) is partly to blame for confusion in the area by contending that Say's Law amounts to "the proposition that there is no obstacle to full employment" (1936, p.26). This naïve conflation of goods and labour market equilibrium, which cannot be pinned on the classics (Sowell, 1972, p.210), is not innocent in that it provided the theoretical rationale for the type of macroeconomic populism which indiscriminately applies demand stimulation to all forms of unemployment.

The macroeconomic equilibrium condition can now be identified as the coordination requirement which monetary exchange adds to that of barter exchange. The fact that monetary exchange adds a coordination requirement evidently does not imply that plan coordination is necessarily harder to achieve in a money than in a barter economy. The reason is that monetary exchange also considerably lightens the burden of the coordination requirement carried over from barter: the microeconomic equilibrium condition.

How money does so can simply and effectively be explained with the aid of the technology of monetary exchange alone. It is already an old Hayekian insight that the microeconomic coordination challenge is essentially about knowledge – knowledge of who supplies/demands what, where, when, in what quantity and at what price. Money aids plan coordination by economising on the knowledge needed in this regard. It does so by ensuring that traders are prescient about the identity of one of the two commodities in every exchange: money itself (Kohn, 1988; Ostroy and Starr, 1990). Strictly speaking, therefore, money does not set aside Jevons's requirement of a double coincidence of wants, but ensures that the knowledge necessary for coincidence in one of the two wants is already obtained. Demanders already know suppliers want money and suppliers already know demanders offer money.

While almost embarrassingly obvious, the role of money as knowledge-economising device is of monumental importance in providing us with the basic rationale for money's utility[5]. Given that

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[4]Of course, microeconomic equilibrium (the absence of disproportionalities) may obtain even when individual goods markets fail, namely when they fail due to a change in aggregate spending which affects all these markets equiproportionally.

[5]There are, of course, further institutional means of economising on the knowledge necessary for market coordina-

the utility of money is thus grounded in its general acceptability rather than its intrinsic value, it follows that fiat money's lack of intrinsic value makes no difference to its utility, provided its general acceptability is not compromised by excessive inflationary purchasing-power losses and legal tender laws continue to be observed[6]. It also follows that the welfare gains of monetary over barter exchange are customarily much understated. They consist not only of the lower transaction cost on a given volume of goods produced and traded, but also, and probably much more importantly, of the larger volume of goods produced and traded owing to the greater specialisation facilitated by the greater ease of monetary trade (Thornton, 2000). Hence theoretical macroeconomics fails to do full justice to the welfare gains of monetary exchange, not only when it inadequately considers the relevant transaction cost savings, but also when it assumes fixed endowments and unchanged technologies.

In short, money aids plan coordination by making it easier to achieve microeconomic equilibrium but remains capable of upsetting plan coordination through a potential failure of macroeconomic equilibrium. Having separate micro- and macroeconomic equilibrium conditions thus permits us to bring out how money can potentially both aid and frustrate market coordination, which is indispensable to any credible theory of monetary exchange. Nonetheless, money's net influence is as a rule coordination aiding, simply because agents would otherwise spontaneously resist adopting or maintaining its services, which they manifestly do not. Barring severe banking crises, monetary disturbances are typically not so large that money ceases to act as a transaction lubricant and becomes, in effect, a transaction friction. Contemporary New Keynesian DSGE modelling can treat money as a friction, precisely because it finds no place for the knowledge-economising role of money: when agents anyhow have perfect knowledge or some stochastic equivalent thereof, the reduction in knowledge requirements brought about by money is irrelevant (cf. Rogers, 2008)[7].

Dividing overall goods market equilibrium into a microeconomic and a macroeconomic component has a further obvious pay-off. It allows a separate determination of relative prices and the general price level along the lines of the classical dichotomy. Relative prices can be determined via the real terms of the microeconomic equilibrium condition and the general price level via the nominal terms of the macroeconomic equilibrium condition. In line with Wicksell ([1898] 1936), the general price level will then change when macroeconomic equilibrium fails (non-neutral money) and remain stable when it holds (neutral money). This is not to deny that macroeconomic equilibrium may also fail and the general price level may also change under the influence of non-monetary supply-side factors, as Wicksell ([1928] 1950, pp. 159ff) himself was careful to emphasise.

While the determination of relative prices in terms of only real quantities merely requires the assumption that monetary disturbances do not cause disproportionalities, the reverse case of explaining real quantities in terms of only relative prices necessitates a much more daring and dangerous assumption, namely that monetary disturbances do not occur at all. Because monetary disturbances clearly cannot *a priori* be ruled out, aggregate income should be acknowledged as depending not only on relative prices but also on the level of aggregate effective demand. Such is the basic proposition of Keynes (1936), which takes it for granted that monetary disturbances cannot always be neutralised by changes in the general price level and that, even if there were the requisite downward flexibility, a falling general price level more likely amplifies than nullifies the disturbance – for reasons to be indicated below. In short, the classical dichotomy may be more or less appropriate for a theory of market price, but it is decidedly inappropriate for a theory of market coordination.

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tion, such as by the use of specialised middlemen (Clower and Howitt, 1996, 2000).

[6] We have derived money's utility from its medium-of-exchange function because we regard that function as primary. This is, however, not to deny that money also has utility in its secondary functions as store of value and unit of account, which, for lack of space, we do not spell out here (but see e.g. Keynes, 1937a and Laidler, 1983).

[7] Woodford (2003, ch.2) also attaches a more specific meaning to monetary frictions. They allegedly follow from the fact that central-bank money (cash) is unique and irreplaceable as a means of final settlement. But while cash may have many equally functional alternatives, money in general does not. The only alternative to monetary exchange is barter exchange, which introduces rather than removes friction. This consideration is lost to view in Woodford's scheme because he abstracts from commercial banking and thus reduces money to cash. Rendering money and cash indistinguishable, Woodford is able to suggest, quite perversely, that the unique and irreplaceable role of money introduces friction.

Contemporary DSGE modelling typically specifies its aggregate goods market equilibrium condition in the style of the microeconomic rather than the macroeconomic equilibrium condition, as $y_t^s = y_t^d$. This formulation has two main drawbacks. First, the monetary dimension to changes in aggregate spending and output is lost to view. Second, the general price level is prevented from being determined in the market for goods. Theorists are then forced to find alternative ways of determining the general price level, such as via the terms of the quantity equation in accordance with the Quantity Theory or via the terms of some government budget equation in accordance with the fiscal theory of the price level, both of which seem equally inappropriate. It seems reasonable to insist that the price of goods be determined in the market for goods, which is not to say that the markets for money and government bonds are irrelevant. They can still indirectly influence the general price level via the aggregate demand for goods. We revisit the issue below.

4 Plan coordination in monetary finance

To help us identify the nature of monetary disturbances, this section derives the terms of a monetary budget equation. On the strength of the momentariness of exchange, only a demanders' budget equation needs to be considered since only the demanders of any trading moment need money as finance for spending. Moreover, in view of the aggregate perspective inherent in money's role as *generally* accepted medium of exchange, we bypass individual budget equations and move straight into the derivation of an aggregate version applicable to all the demanders of a given trading moment. For heuristic reasons, we initially assume a commodity money world without banking, financial markets or international trade which will be relaxed in the next section. Two foundational budget equations are considered: a static Keynesian version and a dynamic Robertsonian version, which are briefly shown to be logically related. We start with the Keynesian version.

Agents do not spend their money all at once. While the odd individual agent may spend all his or her money, any significant grouping never does (velocity is never unity). There are two reasons for this. First, in a radically uncertain world, agents cannot and do not anticipate all their future needs. Second, to the extent that agents do anticipate their future needs, these needs are met by goods whose storage costs are generally higher than that of money (Keynes, 1936, ch.17; 1937a). What this means for the aggregate budget equation is that the actual money inventory of the current moment t ($\sum M_t^s$) must be sufficient to meet not only currently planned spending ($\sum P^y y_t^d$) but also currently desired levels of money inventory ($\sum M_t^d$):[8]

$$\sum M_t^s = \sum P^y y_t^d + \sum M_t^d \tag{7}$$

The summation operator signifies aggregation over all the goods demanders of moment t.

Because our analysis abstracts from behavioural explanation, theories of optimal money inventory are of no concern to us, nor do we need to discuss money demand motives, except to note that active money ($\sum P^y y_t^d$) finances present transactions and passive money ($\sum M_t^d$) finances future transactions (significantly, *all* Keynes's non-transaction motives are about finance for future spending). Part of these future transactions will be anticipated currently, but part of them will also be unanticipated. Agents then adopt a "wait and see" approach, meaning that they leave their spending decisions open in the expectation of obtaining better information later on (Keynes, 1937a). The approach obviously makes sense only in a world of radical Knightian uncertainty which cannot be reduced to stochastic probability. All in all, the demands for active and passive money are equally expressive of money's essential nature as medium of exchange. Both finance transactions.

While plan formation and plan execution can happen during the same period, they cannot occur at the same moment. Hence when transactions are acknowledged as being momentary, plan

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[8]The demand for money to spend is expressed as a demand for goods on the strength of equation of exchange 3, $P^y y_t^d \equiv M E_t^s$, which oddly gives money as a supply rather than a demand. Note, however, that active money is a supply in the sense of being offered in exchange for goods demanded as in equation 3, but a demand in the sense of making claims on money holdings as in budget equation 7.

formation must precede the plan execution of moment t. The important analytical implication is that financial planning errors are possible in principle and the momentary budget equation may fail[9]. It is an equilibrium condition and not an identity, although it may turn into an identity when all its terms are given in realised, *ex post* form. When the budget equation does hold in *ex ante* terms (as a financial planning equilibrium condition), we have achieved what may be called monetary equilibrium or, in Keynes's (1936) parlance, money market equilibrium. Keynes's term is awkward as money does not have its own market and the budget equation expresses financial planning rather than market-exchange equilibrium. Yet Keynes's market label is not devoid of descriptive value in that it is suggestive of scarcity. And the scarcity of money is indeed determined via the terms of a monetary budget equation like 7, which closely resembles Keynes's (1936, p. 199) own money market equilibrium condition but is also different in several subtle but significant respects.

There is no space here to pay attention to all these differences but one must briefly be highlighted. Although Keynes's money market equilibrium condition carries all the hallmarks of a monetary budget equation, it primarily serves as a securities market equilibrium condition – witness how the interest rate is determined via its terms. Because we disregard interest rate theory, we can ignore that quality of Keynes's money market condition and treat it purely as a monetary budget equation, which it clearly also is. This equilibrium condition has at least two important merits.

First, it avoids the trap of expressing money market equilibrium with reference to the demand and supply of money alone, either as an inventory equilibrium ($\sum M_t^s = \sum M_t^d$) or as a market-exchange equilibrium ($\sum ME_t^s = \sum ME_t^d$). To render money market equilibrium as $\sum M_t^s = \sum M_t^d$, which is common to all Walrasian general equilibrium macroeconomics, is inappropriate because it rules out a demand for active money, at least for the current moment or period t ($\sum P^y y_t^d = 0$). Conversely, to render money market equilibrium as $\sum ME_t^s = \sum ME_t^d$ is equally inappropriate because it is identical to the macroeconomic equilibrium condition on the strength of equations of exchange 2 and 3, and therefore superfluous. As noted in section 2, money does not need its own market-transaction equilibrium condition, which, furthermore, rules out a demand for passive money ($\sum M_t^d = 0$). Only by treating money market equilibrium as a monetary budget equation, as Keynes correctly does, can a demand for both active and passive money be simultaneously acknowledged.

Second, insofar as budget equations specify the various uses to which money can be put, they are an indispensible aid in determining the utility of money. Keynes's money market condition is particularly suited for the purpose. It suggests that the utility of current money holding ($\sum M_t^s$) consists of the utility of the goods which agents currently plan to buy with it ($\sum P^y y_t^d$) and the utility of the money which they currently plan to leave unspent ($\sum M_t^d$), which has the important merit of avoiding the pitfall of linking the utility of money either exclusively to the utility of goods (as in the classical Wicksell-Mises view) or exclusively to the utility of generalised buying power (as in the Keynesian view). Both need to feature. The first term ($\sum P^y y_t^d$) suggests the inverse relation between the utility of money and the price of goods, while the second term ($\sum M_t^d$) incorporates the utility of "wait and see", which plays a key role in explaining why liquidity preference increases and spending falls during times of heightened uncertainty (Keynes, 1937a). Tellingly, Marshall (1923, pp.44-45) already employed a budget equation for the purpose determining the utility of money, be it a deficient one.

Of course, monetary budget equations merely help establish *how much* utility a certain amount of money has, not *why* people wish to hold money at all, which is given by money's knowledge-economising role as explained in the previous section. Howitt (1992, 1996) criticises CIA modelling on precisely these grounds. MIU modelling, however, does not fare much better in this regard. While assigning utility to money, it similarly ignores money's knowledge-economising role and thus struggles to find a rationale for that utility. Moreover, because it lacks an appropriately formulated

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[9]According to Clower and Leijonhufvud's (1975a) so-called "rational planning postulate", the budget equation is an identity because rational agents do not currently plan to use more money than they currently have at their disposal. The postulate, however, presupposes that the time dimensions of plan formation and plan execution coincide, which is inappropriate in the light of the momentariness of exchange.

monetary budget equation in the style of equation 7, it cannot identify the determinants of money's utility. Ideally, money should be in the utility function *and* there should be a monetary budget equation.

The clear limitation of the Keynesian budget equation 7 is that it is static, all its variables being attached to the current moment t. When the budget equation is to be made dynamic, the income-spending time lag comes into play. This time lag is, once again, indicative of a radically uncertain world, in which exchange plans cannot be pre-reconciled through a time-zero auction (Clower, 1965; Rogers, 2008). The time lag also establishes the sequential nature of monetary exchange processes, and captures the common notion that monetary exchange separates the acts of supplying (receiving money) and demanding (spending money), which barter unites.

Analytical periods are conceptually awkward constructs. They are like real time periods in that all sorts of things can happen during their allotted time span. But they are also very much unlike real time periods in that these events can take on any sequence, which opens the door to a disregard for the income-spending lag. It is for this precise reason that Lucas (1980) introduces the CIA constraint, which prevents this-period supply from financing this-period demand as it does in Walrasian budget equations. However, because Lucas's model otherwise reduces all uncertainty to stochastic probability and pre-reconciles all trading plans, there really is no need for observing a time lag between income and spending. As Howitt (1992, p. 73) remarks: "To insist on representing separately the acts of purchase and sale ... if these sales were always guaranteed of fulfilment ... would be pedantic" (see also Hellwig, 1993, p.221).

In addition, the CIA constraint is double-edged sword. On the one side, it justifiably prevents this-period *notional* supply from financing this-period notional demand. On the other side, it unjustifiably prevents an equally possible sequence where this-period *realised* supply (= income) finances this-period notional demand, to which Howitt (1992, 1996) refers as CIA modelling's "black hole"[10]. The deeper, underlying problem obviously lies in the fact that period analysis leaves intra-period event sequences unspecified, which can very simply be overcome by giving transacted amounts momentary time references. All relevant event sequences can then be captured by the disparate time dimensions of the variables themselves in the budget equation itself. Such a dynamic budget equation does not need to be augmented by a CIA constraint, because it will itself already respect the income-spending time lag.

Robertson's classic (1940) budget equation provides a useful template for the type of dynamic monetary budget equation which incorporates the income-spending lag (Kohn, 1981a, 1981b; Snippe, 1985b). To arrive at Robertson's version, the supply side of equation 7, $\sum M_t^s$, merely needs to be divided up into various components representing the various ways in which current goods demanders could have obtained their money. If we take the income-spending lag to be period p, the first component consists of the money income which current goods demanders realised when acting as goods suppliers at moment $t - p$, $\sum P^y y_{t-p}^s$. It is thereby conveniently assumed that current demanders were all suppliers at the same past moment $t - p$. The second component consists of newly created money (positive change in the money stock, ΔM^s), which, if we again assume all money creations to have been realised at $t - p$, can be written as $\sum \Delta M_{t-p}^s$[11]. The third component comprises the money which current goods demanders held at $t - p$, $\sum M_{t-p}^s$. This money represents the inheritance from a past before $t - p$ as the net outcome of all the income-spending rounds which took place prior to $t - p$. Breaking $\sum M_t^s$ down into $\sum P^y y_{t-p}^s + \sum \Delta M_{t-p}^s + \sum M_{t-p}^s$ and rewriting $\sum M_t^d$ - $\sum M_{t-p}^s$ as $\sum \Delta M_t^d$, the Keynesian budget equation 7 becomes:

$$\sum P^y y_{t-p}^s + \sum \Delta M_{t-p}^s = \sum P^y y_t^d + \sum \Delta M_t^d \tag{8}$$

[10] Howitt's (1992, 1996) criticism goes a step further by suggesting that the income-spending lag itself is trivial, which seems unwarranted. The income-spending lag appears trivial only because CIA modelling puts far more weight on it than it is meant to carry, namely the weight of sole reason for using money.

[11] In view of our temporary assumption of a pure commodity money regime, the goods demanders of moment t are presumed to include at least one minter.

The meaning of equation 8 is straightforward: the income $(\sum P^y y_{t-p}^s)$ and money creation $(\sum \Delta M_{t-p}^s)$ realised in the past must be sufficient to facilitate the spending $(\sum P^y y_t^d)$ and increased passive money holding $(\sum \Delta M_t^d)$ planned for the present. This budget equation indeed closely resembles Robertson's (1940, p.6) version except that the latter is periodic and expresses income and spending more narrowly as saving and investment (the supply and demand for loanable funds), because Robertson, like Keynes, uses his budget equation as a securities market equilibrium condition. We will again ignore the merits or demerits of equation 8 as a securities market equilibrium condition and consider it purely as a monetary budget equation.

Although both expressions are logically compatible and each has its own valid application, Robertson's budget equation has one outstandingly helpful quality which the Keynesian version lacks: it is a portrayal of the dynamic circular income-spending stream with money creation the typical injection into that stream and increases in passive money holding (hoarding) the typical leakage from it. We explore why this quality is so helpful.

5 Injections, leakages and monetary disturbances

Defining a positive change in aggregate demand as the increase in its current level over past aggregate income $(\sum \Delta P^y y_t^d \equiv \sum P^y y_t^d - \sum P^y y_{t-p}^s)$, the Robertsonian budget equation 8 can be shortened to:

$$\sum \Delta P^y y_t^d = \sum \Delta M_{t-p}^s - \sum \Delta M_t^d \tag{9}$$

This equation embodies the idea that changes in aggregate spending must be accompanied by net monetary injections into, or net leakages from, the circulatory income-spending stream. A monetary disturbance can now more precisely be defined as a net monetary injection or leakage, more in particular one which accompanies a change in aggregate spending away from aggregate supply. There are several significant implications of equation 9.

To start with, it exposes Clower's (1965) income-constrained process as conceptually unsound. Aggregate income can change only when aggregate spending changes, and aggregate spending can change only when there is a net monetary injection or leakage. Changes in both aggregate income and spending must, therefore, be explained with reference to net injections or leakages. Even so, income constraints are not irrelevant. They may explain why a localised fall in demand due to a localised net leakage spreads out over the whole economy, causing a fall in aggregate demand and a generalised net leakage, although money's buffer-stock role may lessen or even arrest that spread (Laidler, 1983). But income constraints cannot explain why demand falls at all, which requires reference to a net monetary leakage.

In addition, equation 9 shows how asset price or wealth effects do not operate via their impact on the income from selling these assets, as erroneously suggested by the wealth constraint, but via their impact on monetary injections or leakages. Price changes do not affect aggregate income but merely redistribute it between sellers and buyers, although this redistribution may affect the size of injections or leakages and, in that way, indirectly influence total spending. For instance, falling house prices may cause a reduction in aggregate spending, not because people realise less income when selling their homes, but because they reduce their demand for mortgage bank loans (or for bank loans in general due to deteriorating net worth) which constitutes a negative injection in the form of net money destruction[12]. In fact, falling house prices may also provoke a negative leakage and thus stimulate spending, for instance when passive money holding falls under the influence of a reduced need for cash savings on the part of first-time home buyers, as suggested by Muellbauer (2007). Similarly, stock market crashes do not depress aggregate spending because they reduce income from selling stocks, but because negative moods and deteriorating balance sheets incline the non-bank public to reduce its demand for bank credit or raise its overall passive money holding.

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[12] Negative injections are obviously equivalent to leakages just as negative leakages can be treated as injections.

The implication for theory is that wealth effects do not need their own channel in the transmission mechanism but can be subsumed under the credit demand channel (cf. Buiter, 2010).

In speaking about money creation through net bank credit extension, we have run ahead of our story and already abandoned our assumed commodity money world. The time is ripe to make explicit how various aspects of a modern fiat money world, like bank money creation, financial intermediation, financial markets and international trade, impact on the shape of budget equations 8 and 9. This impact follows a pattern which we may as well state up front. Any institutional innovation away from the most basic form of commodity money exchange manifests its effect on the circular income-spending stream in the same way: by introducing an additional type of injection into it or leakage from it. Various such additional leakages or injections play a role.

The introduction of bank money creation would appear merely to change the method of money creation (from coin production to banks raising their deposit issue) without affecting the shape of budget equations 8 and 9 which already have a money creation term[13]. But this is not so. Nonbank agents can use part of their financial resources to service their bank debt (pay interest and repay principal), to buy assets from banks, or to invest in banks by purchasing their non-monetary debt or equity. Such disbursements by nonbanks to banks constitute a leakage from the current goods spending round, but also, because they encompass money destruction, a negative injection into the next spending round. Adding this leakage-*cum*-negative-injection term to the budget equation is analytically significant in a number of ways. Among other things, it brings out how a reduction in the general price level not only stimulates real demand by increasing the real value of the money stock (real balance effect), but also discourages real demand by increasing the real value of bank indebtedness. This increased real indebtedness creates an incentive for accelerated repayment of existing debt as well as a disincentive to take up any new bank debt, which reduces spending and shrinks the money supply. Patinkin (1965) could present a misleading view on the power and relevance of the real balance effect precisely because his Walrasian budget equation lacks this leakage-*cum*-negative-injection term.

The introduction of bank money creation also gives rise to the possibility of monetary disturbances causing disproprotionalities with respect to both markets and sectors. After all, some markets (like the market for residential property) and some sectors (like the small business sector) are more dependent on bank credit finance than others, which causes prices and incomes in such markets and sectors to react earlier and more strongly to credit booms and busts than others (Bernanke and Gertler, 1995).

Keynes's (1936, pp. 66-75) strictures on user cost and the resultant integration of the logic of national income accounting into macroeconomic theory has had a downside. In accordance with the logic of national income accounting, macroeconomics has traditionally considered only trade in final goods, but it should, in accordance with the logic of monetary exchange, take account of trade in all goods. Any and every type of tradable gives rise to a supply of monetary finance when sold, and to a demand for monetary finance when bought. Hence an unchanged volume of trade in intermediary goods (including original factors), second-hand goods (mainly existing real estate and second-hand cars) and secondary financial assets does not take up additional finance. But an increase in the volume of such trade does require additional finance and therefore constitutes a leakage potentially capable of crowding out aggregate demand for current output, provided it is not financed by bank cash reserves which do not form part of the nonbank public's money stock[14]. In the *Treatise* Keynes (1930) recognises such a possibility for the case of an increase in trade in secondary financial assets, but in the *General Theory* he (1936) implicitly ignores it for the case of an increase in intermediary and second-hand goods trade, which easily makes up the bulk of total non-financial trade.

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[13] When we speak of a bank, we mean a commercial fractional-reserve bank unless otherwise stated.

[14] The potentially highly disruptive impact of a huge, and hugely variable, financial circulation on the goods circulation is mitigated by clearinghouse netting, financial traders' access to flexible trade credit at their banks (injections and leakages cancel out), and the fact that a significant part of financial trade is conducted by banks between themselves which they finance with cash reserves (central bank deposits) rather than money proper. Regrettably, these mitigating factors are potential sources of instability too.

Contrary to increased trade in secondary securities, increased trade in primary securities (lending and borrowing) does *not* require the introduction of an additional leakage term. In fact lending and borrowing, because they cancel out in aggregation, should not feature in an aggregate monetary budget equation at all. They influence aggregate spending via the leakage and injection terms already present in the budget equation: decreased passive money holding and money creation. When funds are non-intermediated or nonbank-intermediated, an increase in the successful channelling of funds from deficit to surplus units gives rise to a negative leakage in the form of a reduction in overall passive money holding. When bank intermediated, an increase in bank lending to nonbanks generates an injection in the form of money creation. Whereas the former more efficiently allocates existing liquidity, the latter adds liquidity.

Indeed, because banks finance their lending and spending with deposits issued by themselves rather than with deposited cash, they hardly function as intermediaries between ultimate borrowers and lenders. Startlingly, just about the entire literature on the economics of banking since at least Bernanke and Blinder (1988) regards commercial banks as intermediaries indistinguishable from savings banks, as similarly noted by Bossone (2001). The more recent treatments by Cúrdia and Woodford (2009), Woodford (2010) and Adrian and Shin (2010) still regard banks as intermediaries who finance their lending and spending with deposited savings[15]. Goodfriend and McCallum (2007) are the exception to the rule. They explicitly view commercial banks as creators of money, but incorporate money creation in the CIA constraint, which is problematic for reasons expounded below.

Although lending and borrowing, along with transfers, should not feature in an aggregate budget equation, they may legitimately appear in sectoral budget equations, provided the funds move between sectors and the borrowing is not from banks, in which case it should be categorised as sectoral money creation. The budget equations of firms, households, nonbank intermediaries and government can otherwise follow the template provided by equations 7 or 8. The budget equation of money-creating commercial banks is different, because the type of liquidity which constrains their lending and spending consists of cash (central-bank issued money) rather than money more broadly (cash plus deposits issued by themselves) (Hicks, 1989, pp.61-63). Hence the banking sector has a *cash* budget equation. The precise form of this budget equation or the degree to which the banking sector faces a cash constraint on credit extension, need not be elaborated here.

To sum up, then, the linkage between the financial system and the real sector runs through monetary injections and leakages: changes in the money stock, changes in the level of passive money holding and changes in the volume of trade in secondary asset markets insofar as these are financed by money proper, the net effect of which determines the impact on total current goods spending. Models wishing to take account of the financial system will at least have to incorporate these three injection/leakage terms, and determine their net effect.

Moving on to international trade, imports and exports have a dual nature. They are part of the income-spending stream as well as a leakage from, or injection into, that stream. Imports represent a form of spending (on foreign goods) as well as a reduction in the money stock, just as exports

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[15]Because DSGE's default position is one of perfect financial markets, the introduction of bank intermediation does not contribute to lender-borrower coordination but takes away from it. Like money, intermediation is treated as introducing rather than removing friction, in Cúrdia and Woodford's (2009) case by causing borrowers to pay a premium over the interest rate which lenders receive. Moreover, Cúrdia and Woodford's (2009) banks don't issue monetary deposits let alone create any money – all in a desperate bid to keep their model free from monetary frictions. In justifying this disregard for commercial banking, Woodford (2010, p.26) notes how commercial banks are no longer "the most important marginal suppliers of credit [nor are monetary] deposits [their] most important source of funding", which is simply untrue. Because it involves money creation, the supply of credit by commercial banks remains uniquely important, whatever its share in the total supply of credit. In addition, commercial banks initially finance all their lending and spending with monetary deposits, part of which the public subsequently uses to pay for their investment in the non-monetary deposits, debt and equity of banks. Since payment to banks extinguishes money, monetary deposits thus merely get exchanged for other forms of funding for banks, with no change in the liability total of the banking sector's balance sheet. Monetary deposits are thus the original source of *all* commercial-bank funding, whatever form it takes.

are a source of income (from selling local goods to foreigners) as well as an increase in the money stock. To prevent a double-count, imports and exports should, therefore, be incorporated either as part of income and spending or as changes in the money stock, but not as both. Keynesian income-spending analysis fortuitously avoids such a double-count by altogether ignoring monetary injections and leakages, as will be seen in section 6.1 below. International trade in securities can *mutatis mutandis* be incorporated in the budget equation in the same way.

Generalised to take account of all types of injection and leakage, budget equations 8 and 9 can be adapted in the following straightforward manner:

$$\sum P^y y^s_{t-p} + \sum Injections_{t-p} = \sum P^y y^d_t + \sum Leakages_t \tag{10}$$

$$\sum \Delta P^y y^d_t = \sum Injections_{t-p} - \sum Leakages_t \tag{11}$$

The shortened budget equation 11 raises at least two issues worthy of brief mention. First, it highlights how injections and leakages can be causally related to each other rather than to changes in aggregate demand, such as when money creation finances an increase in secondary financial trade, which is why money creation need not be well correlated with income growth. Second, the causality in equation 11 cannot be treated as uni-directional. Whether money creation is endogenously determined by the nonbank public's spending plans or by parties exogenous to it (the central bank, the government, banks or the foreign sector) depends on the particular mode in which money is created. Because all these modes will simultaneously play a role, total money creation will always be partly endogenous and partly exogenous. Even so, the bulk of money creation is endogenously determined by increases in the nonbank public's net demand for bank credit, taking it for granted that the banking sector is stable, the central bank fully accommodates the banking sector's cash needs at its target interest rate level (as it is forced to do), and credit rationing criteria remain roughly unchanged. During times of banking crisis, however, banks may dramatically raise their credit rationing due to cash shortages or deteriorating balance sheets, which then becomes a powerful exogenous determinant of changes in the money stock.

The full Robertsonian budget equation 10 suggests how, at any given trading moment, only some agents finance their spending with newly created money, while most finance their spending with existing money (recently earned income or hoards), which is fixed and given for that moment. Hence even when money creation were fully endogenously determined by the public's demand for credit, the majority of the public still faces a finance constraint on its demand. Endogenous money creation cannot, therefore, cause prices to become indeterminate, although it may cause them to rise precipitously. The Friedman-Schwartz price indeterminacy argument presupposes that *all* goods are simultaneously traded through a Walrasian auction in which *all* participants finance *all* their spending with money creation, which is evidently quite far from what money endogeneity is about in reality.

6   Assessing commonly used equilibrium conditions

6.1   *Keynesian goods market equilibrium: the disappearance of monetary injections and leakages*

Textbook Keynesian ISLM theory has powerfully shaped macroeconomic intuition and its basic structure continues to be used by some more sophisticated contemporary analyses. It is, therefore, worthwhile to investigate the conceptual soundness of its equilibrium conditions. Leaving the interest rate theory of LM curve analysis aside, we focus our attention on IS curve analysis and its goods market equilibrium condition[16]. But first a slight detour.

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[16]The credibility of Keynesian LM curve analysis is anyhow already on the wane, especially since Woodford (2003) has rejected it in favour of a central-bank determined interest rate, the obvious good sense of which need not be further highlighted here.

The macroeconomic equilibrium condition and the monetary budget equation are fundamentally different concepts: the one expresses market equilibrium, the other financial planning equilibrium. Nonetheless, their formal expressions can be brought into considerably closer alignment by assuming a stationary state up to the present moment t. This allows us to treat realised income from the past as equivalent to currently planned output ($\sum P^y y_{t-p}^s = \sum P^y y_t^s$), as Hicks (1946, p. 119) similarly notes: "It is only in a stationary state that ... income does not need to be distinguished from production". Macroeconomic equilibrium can then be given the more familiar Wicksellian and Keynesian shape of an income-spending equality ($\sum P^y y_{t-p}^s = \sum \mathbf{P}^y \mathbf{y}_t^d$), which turns into a saving-investment equality when consumption spending is subtracted from both sides and set y is taken to consist of final goods only.

Furthermore, while the budget equation is an equilibrium condition, only a small change to its form suffices to turn it into an identity. When the variables on its demand side are given in effective terms as actual money spending and actual money leakages, it becomes what is, in effect, an *ex post* accounting identity: $\sum P^y y_{t-p}^s + \sum Injections_{t-p} \equiv \sum \mathbf{P}^y \mathbf{y}_t^d + \sum \mathbf{Leakages}_t$. It thus transpires how macroeconomic equilibrium as an income-spending equality ($\sum P^y y_{t-p}^s = \sum \mathbf{P}^y \mathbf{y}_t^d$) is virtually the same as an *ex post* monetary budget equation stripped from its injections and leakages ($\sum P^y y_{t-p}^s \equiv \sum \mathbf{P}^y \mathbf{y}_t^d$), the only difference being that the latter is an identity.

This sheds light on the mysterious nature of Keynes's (1936) aggregate goods market equilibrium condition which he indeed treats as an income-spending identity and yet regards as compatible with goods market failure. The compatibility with goods market failure is achieved when the stationary state is given up, so that income no longer serves as a proxy for currently planned output. But the income-spending equality can then no longer be treated as a goods market equilibrium condition. It turns into a truncated monetary budget identity, an *ex post* circulatory income-spending stream without injections and leakages. Several logical problems arise from the absence of monetary injections and leakages from the income-spending stream of IS curve analysis.

Lacking monetary injections and leakages, IS curve analysis is forced to attribute increases in income to increases in autonomous spending. The problem then arises that these spending increases are unfinanced. They happen without there being any net monetary injections to fund them, which amounts to a contradiction in terms: spending without anything to spend. Part of the necessary funds may become available through dampened passive money holding and reduced endogenous spending, as resulting from a raised interest rate in the sphere of LM curve analysis. But this does not solve the problem, because the interest rate can only rise *after the fact*, that is, as a consequence of the unfinanced spending already having taken place.

The absence of monetary injections and leakages from his income-spending stream is also responsible for the ambiguous meaning which Keynes (1936) assigns to saving and investment. On the one hand, the saving-investment equality is treated as representative of the income-spending stream itself (especially in Keynes, 1937b, 1937c), in which case it is claimed to hold by definition in line with Keynes's goods market equilibrium condition. On the other hand, saving is also regarded as a leakage from that circulatory stream and investment as an injection into it, such as when it is suggested that aggregate demand fails because investment is insufficient to make up for the saving gap (1936, pp. 27-28), in which case the saving-investment equality must be allowed to fail and is not an identity.

The mere handling of saving as a leakage and investment as an injection is already conceptually unsound. Defined as unconsumed income, saving constitutes a supply of monetary finance and as such *cannot* be a leakage; it becomes a leakage only when giving rise to increased passive money holding. And investment as a spending item constitutes a demand for monetary finance and as such *cannot* be an injection; it becomes an injection only when presumed to be financed by money creation through bank credit extension. The contradiction then arises that IS curve analysis implicitly assumes endogenous money while LM curve analysis presupposes exogenous money.

The Kahn-Keynes multiplier process is forced to treat the circulatory income-spending stream as a "deviation-amplifying feedback loop" (Howitt, 2006; Leijonhufvud, 2009) precisely because

it knows no monetary injections or leakages. As with Clower's income-constrained process, the income effects of the multiplier process are applicable only to the case of a localised change in spending (a localised disturbance) spreading out over the whole economy causing a multiple change in aggregate spending (a generalised disturbance). As with Clower, it is thereby assumed that this local change, during its spread, is not partially or wholly neutralised by contrary change elsewhere in the economy. But the multiplier process cannot explain why changes in *aggregate* spending multiply themselves. Self-reinforcing changes in aggregate spending require self-reinforcing monetary injections or leakages, such as what happens to money creation or destruction levels during the up- or downswing in the classic credit cycle, which may create the appearance of a Kahn-Keynes multiplier but has nothing to do with its logic.

Equation 11 suggests that aggregate spending changes are best explained indirectly, via injections and leakages. Keynes's (1936) diametrically opposed method is to bypass injections and leakages in order directly to explain aggregate spending changes. This method, which has dominated macro analysis ever since the appearance of the *General Theory*, must be regarded as theoretically inferior, although there may be pragmatic reasons for adopting it in the practice of applied analysis. It is theoretically inferior because it implicitly lumps together all injection and leakage terms, each of which has its own, often quite different, causal mechanism and causal direction. Separately explaining each injection term (all the different modes of money creation) and each leakage term (increased hoarding and increased trade volumes in all the different non-currently, non-locally produced goods, including secondary financial assets) must yield a superior explanation of aggregate income changes, although the analysis will be more cumbersome. For that reason Woodford (2003, 2006) may, for instance, be justified in adopting the relative simplicity of the Keynesian short-cut, which will indeed not produce significantly inferior results when injections and leakages cancel out or when changes in the money stock are predominantly endogenously determined by changed spending plans. Money and spending changes can then be explained with reference to roughly the same variables, mainly the interest rate. But this clearly cannot always be relied upon. At the level of pure theory, therefore, the Keynesian method is to be resisted. It ironically reduces the generalness of theory and leaves it open to the oversight of potentially important sources of monetary disturbance.

Not surprisingly and a testimony to Keynes's monumental influence, textbook representations of the circular flow of money invariably leave out monetary injections and leakages. Macroeconomic understanding has been the poorer for it.

6.2 *The quantity equation*

Despite its apparent simplicity, Fisher's quantity equation is a deceptively confusing construct in that it is open to being interpreted as an equation of exchange, a monetary budget equation and even a macroeconomic equilibrium condition. Although conventionally referred to as the equation of exchange (see e.g. Bordo, 2002), the label must be a misnomer. If the quantity equation were to express the *quid pro quo* in exchange, it would have to describe either the *quid pro quo* of money demanded for goods supplied (as in equation 2) or the *quid pro quo* of money supplied for goods demanded (as in equation 3), but could not say anything about the scarcity of money as shaped by *both* the supply and demand for money. And the Quantity Theory clearly does intend to determine the general price level by the scarcity of money.

If intended to capture the determinants of the scarcity of money, Fisher's quantity equation must be interpreted as a periodic monetary budget equation with MV being the periodic supply of monetary finance and PT its periodic demand. This interpretation would also make sense of the Quantity Theory's bias against cost-push factors, because current goods demand plans do, but current goods supply plans do not, feature in monetary budget equations. The interpretation of the quantity equation as a macroeconomic equilibrium condition with PT representing the supply of goods and MV the demand for goods (see e.g. Patinkin, 1965, pp. xxiii, 166; Laidler, 1991) is thereby also disqualified, as it would mean that the Quantity Theory should not display this bias,

which it clearly does. Wicksell ([1928] 1950, pp. 159ff) already criticised the Quantity Theory for this bias, which is nonetheless perpetuated by contemporary theorists insofar as they determine the general price level via the terms of the quantity equation. As noted before, the price of goods should obviously be determined in the market for goods via the macroeconomic equilibrium condition and not in the market for money via any type of monetary budget equation, even if the scarcity of money should be acknowledged as capable of indirectly impacting the price level via its influence on the demand side of the macroeconomic equilibrium condition (the aggregate demand for goods).

A similar criticism can be levelled at the fiscal theory of the price level for determining the general price level via the terms of a government budget equation. Woodford's (2005) escape route is to claim that the theory is, nonetheless, useful in avoiding price indeterminacy when endogenous money is assumed (as New Keynesian DSGE modelling does). But we already noted how the Friedman-Schwartz problem is anyhow non-existent. The form of the quantity equation, however, conduces to the logical error underlying the Friedman-Schwartz argument, because it thwarts the distinction between newly created money and existing money. Lacking this distinction, the quantity equation falsely suggests that the endogeneity of newly created money implies the endogeneity of the *total* money supply, which indeed allows for the possibility of the price level becoming indeterminate. Momentary budget equations like equation 8 are, therefore, conceptually superior to periodic ones like the quantity equation.

If Y (real final output) rather than T (real transactions) is used and k is substituted for $1/V$, the Fisher equation turns into the Cambridge cash-balance equation, $\sum M_t^s = kPY$. The apparent superficiality of these differences belies the radically different meaning traditionally given to the latter. Rather than a periodic budget equation, the Cambridge equation is a momentary Walrasian money market equilibrium condition ($\sum M_t^s = \sum M_t^d$), the demand side of which is further explained as a function of income ($\sum M_t^d = kPY$). With a behavioural function embedded in it, the Cambridge equation ceases to be an equilibrium condition whose form, like the Fisher equation, is purely a reflection of the nature of monetary exchange. As such, it is of no further interest to us. Its shortcomings as a Walrasian money market equilibrium condition have also already been addressed.

6.3 *The original Walrasian budget equation*

The original single-period Walrasian budget equation, which featured prominently in Patinkin's (1965) macroeconomics and the research tradition which it spawned, can in our symbols be given as $\sum P^y y_p^s \equiv \sum P^y y_p^d$ in which p stands for the relevant period. When a money market is separately specified and money is presumed to act as a numeraire ($P^M = 1$), the equation turns into:

$$\sum P y_p^s + \sum M_p^s \equiv \sum P^y y_p^d + \sum M_p^d \tag{12}$$

In spite of superficially resembling the Robertsonian budget equation 8, this equation is clearly not a monetary budget identity – witness how the non-monetary supply of goods can function as "finance" for the demand for both goods and money. As such, equation 12 cannot adequately portray monetary injections and leakages in their role as necessary accompaniments of spending changes, in spite of claims to the contrary by Yeager (1968) and Yeager and Rabin (1997). While M is referred to as money, it does not function as money in equation 12.

Rather than a monetary budget identity, equation 12 expresses the necessary equality between the total value of commodities (goods and money) brought to market and the total value of commodities taken away from the market at its close, irrespective of whether traders realised all their planned exchanges or whether trade was effected with money or through barter, which has come to be known as Walras's Law (Lange, 1942). Its validity depends on the seemingly innocuous but pivotal stylisation of a single trading round per period during which an unchanged set of traders seeks to trade an unchanged and uniformly priced set of goods among each other.[17] When exchange is

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[17]The stylisation also causes the Walrasian budget equation to become logically indistinguishable from an equation

acknowledged as being monetary *and* momentary, the moments of demanding and supplying are separated in time and the identity of the goods demanded and supplied, as well as of the traders exchanging them, inevitably changes during the interim. Hence Walras's Law fails in any real world situation with continual monetary trade in different goods among different traders (Tsiang, 1966). Not surprisingly, the scrapping of an arbitrarily chosen market as facilitated by Walras's Law has no imaginable counterpart in economic reality. It is an absurdity.

If the terms of equation 12 are regarded as inventories (things people hold) rather than transactions (things people trade), it turns from a budget equation into a wealth constraint, to which Walras's Law could still apply if total nominal wealth were assumed unchanged during the relevant period. Wealth constraints have the clear drawback of being inapplicable to price theory (including interest rate theory) given the obvious fact that prices are determined via transactions and not via inventories, as noted in section 2. However, inventories become equivalent to transactions when they are assumed to be wholly traded and reduce to zero at the end of the period. But even if that assumption were taken on board, the wealth constraint still allows its wealth items to be bartered for each other, which should already be enough to disqualify all portfolio theory of monetary exchange processes. As explained in section 2, because money is the only inventory item of relevance to macro-monetary analysis, the only inventory equilibrium condition to be considered is the monetary budget equation.

In a general equilibrium world *without* radical uncertainty agents can devise a single, once-and-for-all exchange plan, which is already coordinated prior to going to market. In such a world, optimisation is not constrained by money but by endowments, which is precisely what the Walrasian budget equation expresses. By contrast, in a world *with* radical Knightian uncertainty, agents devise exchange plans on a moment-by-moment basis in the light of their current money holdings and their current, imperfect expectations of the future, both of which are in near-continual flux. In such a world, optimisation – if optimisation is still the word – is constrained by money holdings as featuring in a monetary budget equation. It may be suggested that the former world is a useful approximation of the latter, but the suggestion, apart from being doubtful, diverts attention from the weightier issue which is why analytical technique, and the absence of radical uncertainty which that technique implies, should be decisive in determining theoretical content at all (cf. Caballero, 2010, p.5).

6.4 *The dynamic budget constraint of DSGE modelling*

With the diminished interest in Patinkin-style macroeconomics, the original single-period Walrasian budget equation has in the mean time gone out of fashion. In its place, contemporary DSGE modellers use an infinite sequence of periodic ("flow") budget constraints, which are typically condensed into a single lifetime ("intertemporal") version. The periodic budget equations are different from equation 12 in that they apply to a representative household, allow inventories of wealth to carry over from one period to the next, and no longer invoke Walras's Law. They constitute constraints as inequalities rather than as equalities. Significant variation in their form exists, but their basic structure can, in nominal terms and in our notation, roughly be given like this:

$$P^y y_p^s + W_{bp}^s \geq P^y y_p^d + W_{ep}^d + T_p \tag{13}$$

More detail can be added but this bare version suffices for our purposes. $P^y y_p^s$ and $P^y y_p^d$ represent this period's supply and demand for consumption good y. Inventories of wealth potentially consist of money, bonds and capital ($W = M + B + K$) connected to either the beginning-of-period moment (bp) or the end-of-period moment (ep). The end-of-period demand for wealth (W_{ep}^d) turns into a supply of wealth at the beginning of the next period (W_{bp+1}^s). In Woodford's (2003) benchmark

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of exchange. This explains why Baumol (1965), Patinkin (1989) and Yeager and Rabin (1997) defend the logic of Walras's Law as if it were an equation of exchange, and why Clower (1967) speaks of a "dichotomized budget equation" when considering equations of exchange 2 and 3. To squash the difference between budget equations and equations of exchange seems clearly undesirable; these *are* different things.

model where wealth is confined to money and bonds, interest is accumulated during the time void in between periods. T_p denotes this-period transfers. Insofar as the transfers are between government and households, they are connected to a conventional government budget constraint which need not concern us here. A CIA constraint, typically given as $M_{bp}^s \geq P^y y_p^d$, can be added. Because we abstract from behavioural explanation, optimising conditions are ignored. Equation 13 raises various questions.

To start with, its sectoral-household nature is puzzling. Insofar as budget equations play a role in the explanation of macro, economy-wide phenomena, they should surely be given in their macro, economy-wide form too. The fact that economy-wide budget equations are shunned is, of course, not surprising, since such budget equations cannot incorporate transfers or a demand and supply of primary bonds, which cancel out in aggregation. As explained in section 5, lending, borrowing and transfers influence aggregate spending indirectly, via their impact on monetary leakages or injections. But that is a dead-end for DSGE modelling, since monetary injections and leakages cannot adequately be incorporated in equation 13 for the same reason that equation 12 couldn't: it is not a monetary budget equation. The mere fact that equation 13 can be augmented by a CIA constraint, already suggests its non-monetary nature. Again, M may be referred to as money, but it does not function as money in equation 13.

Like equation 12, equation 13 is an endowment constraint rather than a money constraint. Typical of all general equilibrium analysis, DSGE modelling allows its representative agent to formulate a single, comprehensive exchange plan for all time. As noted in the previous section, optimisation is then not constrained by money but by endowments, potentially consisting of goods, "money" and factors – depending on the type of model. In addition to endowments, equation 13 also incorporates bonds, which disappear again from its lifetime version. Bonds come in handy because, as wealth, they are transferable between periods and thus facilitate an interest rate which expresses time preference and can be interlinked with a real growth rate and an inflation rate. DSGE modelling is thus enabled to capture Ramsay-type perspectives. Despite this clear analytical advantage, equation 13 is still an endowment constraint and, as such, remains as inapplicable to a world of Knightian uncertainty and money as equation 12.

In certain respects, equation 13 may even be regarded as more artificial. Equation 12, for all its shortcomings, was at least a constraint on transactions, given that traditional optimisation in the mould of Arrow-Debreu and Patinkin is about the optimal allocation of *different* commodities among *different* agents (inter-personal or inter-sectoral allocation). Dynamic optimisation, by contrast, is about the optimal allocation of the *same* commodities held by the *same* representative household over *different* periods (inter-period allocation). Hence equation 13 is in essence a constraint on inventory holdings, really an individual-household wealth constraint.

The CIA constraint makes more conceptual sense, being closely akin to the Keynesian budget equation 7 except that it typically excludes a demand for passive money. Its main defect lies in the fact that, for purposes of dynamic modelling, it would have been better to use the dynamic Robertsonian than the static Keynesian version. The deeper conceptual problem, however, is that monetary budget equations serve no purpose in a general equilibrium world without radical Knightian uncertainty (Howitt, 1992, 1996), which is essentially why Woodford (2003) can remove the monetary friction of a CIA constraint from his model and produce roughly similar results. In a world with radical uncertainty both the budget constraint and the CIA constraint can be scrapped in favour of a single monetary budget equation, which cannot be removed from any model of monetary exchange without rendering it incoherent.

References

[1] Adrian, Tobias and Hyun Song Shin (2010). Financial intermediaries and monetary economics. *Federal Reserve Bank of New York Staff Reports*, no. 398.

[2] Baumol, William J. (1965). *Economic theory and operations analysis.* 2nd edition. Englewood Cliffs: Prentice-Hall.

[3] ___ (1977). Say's (at least) eight laws, or what Say and James Mill may really have meant. *Economica* 44: 145-62.

[4] ___ (1999). Retrospectives: Say's law. *Journal of Economic Perspectives* 13: 195-204.

[5] Bernanke, Ben S. and Allen S. Blinder (1988). Credit, money and aggregate demand. *American Economic Review* 78: 435-439.

[6] Bernance, Ben S. and Mark Gertler (1995). Inside the black box: the credit channel of monetary policy transmission. *Journal of Economic Perspectives* 9: 27-48.

[7] Bordo, Michael (2002). Equation of exchange. In John Eatwell, Murray Milgate and Peter Newman (eds) *The new Palgrave: a dictionary of economics.* Basingstoke: Palgrave.

[8] Bossone, Biagio (2001). Do banks have a future? A study on banking and finance as we move into the third millennium. *Journal of Banking & Finance* 25: 2239-2276.

[9] Buiter, Willem H. (2009), The unfortunate uselessness of most "state of the art" academic monetary economics, *VoxEU.* http://www.voxeu.org/index.php?q¹/₄node/3210.

[10] ____ (2010). Housing wealth isn't wealth. *Economics* 3: 2010-2022. http://www.economics-ejournal.org/economics/journalarticles/2010-22.

[11] Cabellero, Ricardo J. (2010). Macroeconomics after the crisis: time to deal with the pretence-of-knowledge syndrome. NBER Working Paper 16429.

[12] Clower, R. W. (1965). The Keynesian counter-revolution; a theoretical appraisal. In F.H. Hahn and F.P.R. Brechling (eds.), *The theory of interest rates.* London: Macmillan, 103-25.

[13] ___ (1967). A reconsideration of the micro foundations of monetary theory. In same (ed.) (1969), *Monetary theory; selected readings.* Harmondsworth: Penguin, 202-11.

[14] Clower, R. W. and A. Leijonhufvud (1975a). Say's principle; what it means and doesn't mean. *Intermountain Economic Review* 4: 1-16. Reprinted in A. Leijonhufvud (1981), *Information and Coordination; Essays in Macroeconomic Theory.* New York and Oxford: Oxford University Press, pp. 79-102.

[15] ___ and A. Leijonhufvud (1975b). The coordination of economic activities: a Keynesian perspective. *American Economic Review; Papers and Proceedings* 65: 182-8.

[16] ___ and P. Howitt (1996). Taking markets seriously: groundwork for a post Walrasian macroeconomics. In David Colander (ed.), *Beyond microfoundations: post Walrasian macroeconomics.* Cambridge: Cambridge University Press, 21-38.

[17] ___ and ___ (2000). The emergence of economic organisation. *Journal of Economic Behaviour and Organisation* 41: 55-84.

[18] Colander, David, Peter Howitt, Alan Kirman, Axel Leijonhufvud and Perry Mehrling (2008). Beyond DSGE models: toward an empirically based macroeconomics. *American Economic Review* 98: 236-40.

[19] Cochrane, J. H. (1998). A frictionless view of US inflation'. In B. S. Bernanke and J. J. Rotemberg, eds. *NBER Macroeconomics Annual*, 13(1), pp. 323-384, Cambridge MA: MIT Press.

[20] Cochrane, J. H. (2005). Money as stock. *Journal of Monetary Economics*, 52(3): 501-528.

[21] Cúrdia, Vasco and Michael Woodford (2009). Credit frictions and optimal monetary policy. *BIS Working Paper* 278. Basle: BIS.

[22] Du Plessis, Stan (2010). Implications of the financial crisis for models in monetary policy. *Journal of Economic Methodology* 17: 429-444.

[23] Fayazmanesh, Sasan (2006). *Money and exchange: folktales and reality.* London: Routledge.

[24] Fisher, Irving (1906). *The nature of capital and income.* New York: Macmillan.

[25] ___ (1926). *The purchasing power of money.* New York: Macmillan.

[26] Greig, Avner (1997). Contracting, enforcement, and efficiency: economics beyond the law'. In M. Bruno and B. Pleskovic (eds.), *Annual World Bank conference on development economics.* Washington (DC): The World Bank.

[27] ___ (2000). The fundamental problem of exchange: a research agenda in historical institutional analysis. *European Review of Economic History* 4: 251-84.

[28] Goodfriend, Marvin, and Bennett T. McCallum (2007). Banking and interest rates in monetary policy analysis: a quantitative exploration. *Journal of Monetary Economics* 54: 1480-1507.

[29] Goodhart, Charles (1998). The two concepts of money: implications for the analysis of optimal currency areas. *European Journal of Political Economy* 14: 407-32.

[30] ____ (2005). *The foundations of macroeconomics: theoretical rigour versus empirical realism.* IRES Conference on the history of macroeconomics.

[31] ____ (2009). The continuing muddles of monetary theory: a steadfast refusal to face facts. *Economica* 76: 821-830.

[32] Hall, Robert E. (2010). Why does the economy fall to pieces after a financial crisis? *Journal of Economic Perspectives* 24: 3-20.

[33] Handa, Jagdish (2009). *Monetary economics.* Second Edition. London and New York: Routledge.

[34] Harrison, Glenn W. (1980). The stock-flow distinction: a suggested interpretation. *Journal of Macroeconomics* 2: 111-28.

[35] Hellwig, Martin F. (1993). The challenge of monetary theory. *European Economic Review* 37: 215-242.

[36] Hicks, J. R. (1935). A suggestion for simplifying the theory of money. *Economica* 2: 1-19.

[37] ___ (1946). *Value and capital.* Second edition. Oxford: Clarendon Press.

[38] ___ (1965). *Capital and growth.* Oxford: Clarendon Press.

[39] ___ (1989). *A market theory of money.* Oxford: Clarendon Press.

[40] Hoover, Kevin D. (2010). Idealizing reduction: the microfoundations of macroeconomics. *Erkenntnis* 73: 329-347.

[41] Howitt, Peter (1992). Cash-in-advance economy. In J. Eatwell *et al.* (eds), *The New Palgrave Dictionary of Money and Finance*, vol. 1, pp. 318–19. London: Macmillan.

[42] —— (1996). Cash in advance, microfoundations in retreat. In D. Vaz and K. Velupillai (eds), *Inflation, Institutions and Information: Essays in Honour of Axel Leijonhufvud.* London: Macmillan.

[43] ____ (2006). The microfoundations of the Keynesian multiplier process. *Journal of economic interaction and coordination* 1: 33-44.

[44] Keynes, J.M. (1930). *A treatise on money.* London: Macmillan.

[45] ___ (1936). *The general theory of employment, interest and money.* London: Macmillan.

[46] ___ (1937a). The general theory of employment. *Quarterly Journal of Economics* 51: 209-223.

[47] ___ (1937b) Alternative theories of the rate of interest. *Economic Journal* 47: 241-252.

[48] ___ (1937c) The 'ex ante' theory of the rate of interest. *Economic Journal* 47: 663-669.

[49] Kiyotaki, N. and Wright, R. (1989). On money as a medium of exchange. *Journal of Political Economy* 97: 927–54.

[50] Kohn, Meir (1981a). In defence of the finance constraint. *Economic Inquiry* 19: 177-95.

[51] ___ (1981b) A loanable funds theory of unemployment and monetary disequilibrium. *American Economic Review* 71: 859-879.

[52] ___ (1988). *The finance constraint theory of money: a progress report.* Unpublished mimeo. Department of Economics, Dartmouth College.

[53] Laidler, David (1983). On the 'buffer stock' notion in monetary economics. *Economic Journal* 94: 17-34.

[54] ____ (1991). The quantity theory is always and everywhere controversial – why?" *Economic Record* 67: 49-64.

[55] ____ (1997). Notes on the microfoundations of monetary economics. *Economic Journal* 107: 1213-23.

[56] Lange, O. (1942). Say's law: a restatement and criticism. In O. Lange, F. McIntyre, and T.O. Yntema (eds.), *Studies in mathematical economics and econometrics.* Chicago: University of Chicago Press, pp. 49-68.

[57] Leijonhufvud, A. (2009). Limits to the equilibrating capabilities of market systems. *Journal of Economic Interaction and Coordination* 4: 173-182.

[58] Lucas, Robert E. (1980). Equilibrium in a pure currency economy. *Economic Inquiry* 18: 203-220.

[59] ____ (1996). Nobel lecture: monetary neutrality. *Journal of Political Economy* 104: 661-682

[60] Marshall, A. (1923). *Money, credit and commerce.* London: Macmillan.

[61] McCallum, B. (2003). *Monetary policy in economies with little or no money.* Unpublished mimeo. Carnegie Mellon University/National Bureau of Economic Research.

[62] Meeusen, Wim (2010) *Wither the microeconomic foundations of macroeconomics?* Unpublished mimeo. University of Antwerp.

[63] Muellbauer, John (2007). Housing, credit and consumer expenditure. In *Federal Reserve Bank of Kansas City Symposium Proceedings*: 1-62.

24

[64] Myrdal, Gunnar (1939). *Monetary equilibrium*. London: William Hodge and Co.

[65] Niehans, J. (1987). Classical monetary theory, new and old." *Journal of Money, Credit and Banking* 19: 409-424.

[66] Ostroy, Joseph M. and Ross M. Starr (1974). Money and the decentralisation of exchange. *Econometrica* 42: 1093-1113.

[67] Ostroy, Joseph M. and Ross M. Starr (1990). The transaction role of money. In B. Friedman and F.H. Hahn (eds), *Handbook of Monetary Economics*, vol. I, Amsterdam: North-Holland, pp. 3-62.

[68] Patinkin, Don (1965). *Money, interest and prices*. Second edition. New York and Tokyo: Harper International.

[69] ___ (1989). Walras' law. In Eatwell, John, Milgate, Murray and Newman, Peter (eds) *The New Palgrave: General Equilibrium*, London and Basingstoke: Macmillan, pp. 328-339.

[70] ___ (2008). Neutrality of money. In Steven N. Durlauf and Lawrence E. Blume. The new Palgrave. Second edition. Basingstoke and New York: Palgrave Macmillan.

[71] ___ and Otto Steiger (1989). In search of the "veil of money" and the "neutrality of money": a note on the origin of terms. *Scandinavian Journal of Economics* 9: 131-146.

[72] Robertson, D. H. (1926). *Banking policy and the price level*. London: P.S. King and Son.

[73] ___ (1940). *Essays in monetary theory*. London: P.S. King and Staples.

[74] ___ (1966). *Essays in money and interest*. London: Collins.

[75] Rogers, Colin (2008). Money as friction: conceptual dissonance in Woodford's *Interest and Prices*. *Research paper* 2008-03. University of Adelaide, Australia.

[76] Sexton, R.L., P.E. Graves, D.R. Lee, and R.W. Clower (1992). Incorporating inventories into supply and demand analysis. *Atlantic Economic Journal,* 20, 41-45.

[77] Sims, Christopher (1994). A simple model for the determination of the price level and the interaction of monetary and fiscal policy. *Economic Theory* 4: 381-399.

[78] Snippe, Jan (1985a). Loanable funds theory versus liquidity preference theory. *De Economist* 133: 120-150.

[79] ___ (1985b). On the integration of spending and portfolio decisions and the coordination problem in macroeconomic analysis. *Metroeconomica* 35: 293-306.

[80] ___ (1987). Momentary equlibrium versus the Wicksell connection. *Banca Nazionale del Lavoro Quarterly Review* 161: 197-212.

[81] Sowell, Thomas (1972). *Say's Law: an historical analysis*. Princeton: Princeton University Press.

[82] Tsiang, S. C. (1956). Liquidity preference and loanable funds theories, multiplier and velocity analysis: a synthesis. *American Economic Review* 46: 540-64.

[83] ___ (1966). Walras' law, Say's law and liquidity preference in general equilibrium analysis. *International Economic Review* 7: 329-345.

[84] ___ (1980). Keynes's finance demand for liquidity, Robertson's loanable funds theory and Friedman's monetarism. *Quarterly Journal of Economics* 94: 467-91.

[85] Thornton, Daniel L. (2000). Money in a theory of exchange. *Federal Reserve Bank of St. Louis Review* Jan/Feb: 35-60.

[86] Visser, H. (2002) The neutrality of money. In Brian Snowdon and Howard R. Vane (eds.), *Encyclopedia of Macroeconomics.* Cheltenham: Edward Elgar, pp. 526-32.

[87] Walsh, C.E. (2005) Interest and Prices; a Review Essay. *Macroeconomic Dynamics* 9: 462-468.

[88] Wicksell, Knut ([1898] 1936). *Interest and Prices*, London: Macmillan.

[89] ___ ([1928] 1950). *Lectures on Political Economy* (Vol. 2: Money), London: Routledge & Kegan Paul.

[90] Woodford, Michael (1996). Control of the public debt: a requirement for price stability? *NBER Working Paper* 5684.

[91] ___ (2003). *Interest and prices: foundations of a theory of monetary policy,* Princeton: Princeton University Press.

[92] ___ (2005). *After monetary theory.* Unpublished mimeo. Conference on Monetary Theory, University of Western Ontario, March 10-13.

[93] ___ (2006). *How important is money in the conduct of monetary policy?* Paper presented at the Fourth ECB Central Banking Conference.

[94] ___ (2010). Financial intermediation and macroeconomic analysis. *Journal of Economic Perspectives* 24: 21-44.

[95] Yeager, Leland B. (1968). Essential properties of the medium of exchange. *Kyklos* 21: 45-69.

[96] ___ (1986). The significance of monetary disequilibrium. *Cato Journal* 6: 369-99.

[97] ___ (1997) *The fluttering veil; essays on monetary disequilibrium.* Edited by George Selgin. Indianapolis: Liberty Fund.

[98] ___ and Alan A. Rabin (1997). "Monetary aspects of Walras's law and the stock-flow problem." *Atlantic Economic Journal* 25: 18-36.