

ALTERNATIVE MONETARY REGIMES: ARE THEY OPERATIONAL?

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1. Introduction

1.1. Alternative Monetary Regimes

Several scholars, notably Black (1970), Hayek (1976), Fama (1980, 1983), Hall (1982), White (1984) and Greenfield and Yeager (1983, 1989), have recently focussed attention on the possibility and in some cases desirability of alternative monetary regimes or payments systems¹. These alternatives all involve the removal of banking regulations as we know them today, the possible replacement of these regulations with others, and the emergence of institutional arrangements ranging from competitive currency issue to 'cashless' or accounting systems of exchange. These institutional arrangements purportedly have properties making them preferable to existing fiat currency regimes, such as a stable price-level (Hall 1982), the elimination of 'painful monetary disequilibrium' (Greenfield and Yeager 1983, 1989), or a banking system not prone to systemic financial crises (White 1984).

The roots of the proposals we consider can often be traced back to either or both of two schools of thought, which we label as *laissez-faire* and *public choice* respectively. The *laissez-faire* doctrine holds that 'free' competition evolves institutional and social arrangements which are superior to those which could be constructed through explicit design and deliberately imposed.

¹This paper ignores the 'legal restrictions' literature (for example Wallace 1988 and Bryant 1989) since this is not so much concerned with an alternative monetary regime as with deriving results about 'money' when it is *purely* a store a value providing *no* medium of exchange services. For a critique of this approach, see White (1987) and McCallum (1983).

According to this view there is a *prima facie* case for unregulated banking²; thus several of the proposals include the removal of existing banking regulations (for instance the prohibition of private currency issue). On the other hand, the principle of *laissez-faire* alone does not elicit any particular well-defined set of institutional arrangements, hence the validity of the principle itself is not an issue we address in this paper³.

Public choice theory has produced a shift from a public-interest to a private-interest interpretation of government activity, in particular the implementation of policy. Thus although monetary authorities purport (and may be perceived) to have certain public-interest objectives, this view contends that they have the incentive and ability to deviate from these objectives. Thus inflationary episodes (for example) are attributed to the discretionary behaviour of the monetary authorities, and alternative monetary systems are posited in order to avoid the 'inherent' inflationary tendencies the public choice view attributes to monetary authorities under existing fiat standards⁴. Cooper (1982) points out, however, that it is questionable whether "one should think that experts are more clever at devising operational nondiscretionary monetary regimes than they are at monetary management within a discretionary

²See for example Hayek (1984) and Dowd (1988).

³Neither do we take up the issue of whether or not there is any inherent role for the government in providing currency (see Vaubel 1984 and Friedman and Schwartz 1986 on this issue).

⁴Goodhart (1989) discusses this in some detail.

regime" (1982:45). His argument is that if the motivation for a nondiscretionary regime is simply another way of assigning priority to the objective of price stability, then we can achieve this directly by instructing existing Central Banks to take whatever action is necessary to achieve price stability. He goes on to note that "if collectively we are ambivalent about [this] priority, [then] that is the principal source of the problem, not the nature of the regime" (1982:45).

According to Cooper's argument, the problem to be addressed is not necessarily the choice of an alternative monetary regime, but rather that of finding incentives which will render the monetary authorities' private interests closest to the public interest. Again, it is not our objective to derive any conclusions regarding this issue.

The objective of this paper, rather, is to test each proposed alternative monetary regime for *operationality* (defined below) according to an analytical method we now specify.

1.2. Methodology

Although the proposed alternative monetary regimes have received critical attention from White (1984), McCallum (1985), O'Driscoll (1987) and Hoover (1988), we are not aware of any systematic and coherent critical appraisal. The main motivation for this paper is that neither the originators nor the critics seem thus far to have provided satisfactory treatments of the 'operationality' of the above proposals. Considering that most of the proposed payments systems are forwarded as potential alternatives to existing fiat currency systems, this is a serious

shortcoming.

For each proposed payments system that this paper considers, the analytical method which is adopted for this objective is as follows:

- (I) The institutional arrangements defining the proposed payments system are specified.
- (II) This payments system is then embedded in an economy in which pricing decisions are made by agents in decentralised markets.

Part (I) of our methodology is relevant since in various parts of the literature institutional specifications are often incomplete, ambiguous or inconsistent. This is typically the consequence of writers assuming that consensus exists as to the meaning of various notions they employ, particularly the term 'money'. Other examples are terms like 'banks' or 'deposits', which are used out of their familiar contexts, without adequate redefinition.

This paper contends that designating a payments system as being either with or without 'money' only leads to confusion, as each reader is likely to consider 'money' in terms of its different possible attributes. The term 'money' is not essential in describing any 'monetary' or payments system, even though it is common to read of the medium of exchange or unit of account functions of money (see Goodhart 1983). Assertions of this kind are misleading because money can only ever be defined in terms of these properties: they are logically prior to any definition of money we may erect. Thus it can only make sense to speak of 'the role of money' once some consistent definition of what 'money' is

has been established⁵.

In this paper the term 'money' is avoided. Instead, the terms 'medium of exchange', 'medium of account' and 'unit of account' as defined in McCallum (1985:5) will constitute our basic terminology. Further terms, such as 'banks' or 'deposits', will be defined, when they arise, in terms of their specific contexts.

Turning to (II) of our methodology, the literature often⁶ implicitly assumes that there *is* some (often unspecified) price adjustment mechanism in the economy which is consistent with (I). Operationality is then *assumed* rather than proved. We address this problem by explicitly adopting, via (II), a framework in which prices are determined in decentralised markets⁷. If it can be shown that (I) is consistent with (II), that is, if the 'rules of the game' defining a payments system can be sustained over time in an economy with market pricing, then we consider the proposed system to be operational. If a system is, or can be made operational we examine whether it indeed has the properties claimed for it, and whether it has any other properties which might be deemed as 'desirable'. This should then enable some greater consensus as to which of the proposals for monetary reform are worthy of further academic discussion and, potentially,

⁵Osborne (1984) notes at least ten discernible approaches to the definition of money in the literature, each emphasising different properties of money. He concludes that only three seem to capture the 'salient' properties of money. All this points to, however, is yet another approach to the definition of money.

⁶White (1984) and Greenfield and Yeager (1989) are exceptions.

⁷Or as Greenfield and Yeager (1983:848) put it, via "honest-to-goodness market activity".

implementation.

1.3. Outline

The structure of the paper is as follows. Chapter 2 examines the operationality of monetary systems which are derivatives of a conventional commodity standard; that is, their common feature is an agency, or competing agencies such as private banks, standing ready to convert the medium of exchange into some commodity or composite commodity at a specified rate. As this characteristic is central to many of the proposals for monetary reform, namely Hall (1982), White (1984) and Greenfield and Yeager (1983, 1989), this chapter forms the major part of this paper. Chapter 3 examines a proposal by Hayek (1976) for a monetary system characterised by competing issuers of inconvertible fiduciary currencies, while Chapter 4 looks at the operationality of accounting systems of exchange as envisaged by Black (1970) and Fama (1980, 1983). The conclusions of the paper are listed in table form on the following two pages. The table outlines the defining characteristics of each proposal, states whether we find it operational, and lists the properties of the regime. Both the commodity standard and free banking regimes have existed as monetary systems in the past, and are thus clearly operational. They are nonetheless included for completeness, as well as for purposes of comparison with other regimes in terms of their properties.

REGIME	RULES	OPERATIONAL?	PROPERTIES
Commodity Standard with a Central Bank (eg. gold standard)	Unit of account defined in terms of a commodity. Central Bank is monopoly issuer of convertible currency. Monetary commodity has a fixed currency price.	Yes	Price level determined by supply of and demand for monetary commodity. Resource cost of convertible currency. Possibility of banking crises.
'Variable' Commodity Standard Fisher (1912) Hall (1982)	As above; but monetary commodity has variable currency price according to feedback rule.	Yes	As Above.
'Free' Banking White (1984)	Unit of account defined in terms of a commodity. Competitively issued convertible currency. Monetary commodity has a fixed currency price.	Yes	As Above.
BFH System Greenfield and Yeager (1983, 1989)	Unit of account defined in terms of a commodity bundle. Competitively issued convertible currency. Indirect redeemability. Two currency prices for the redemption medium.	No	

REGIME	RULES	OPERATIONAL?	PROPERTIES
BFH Variant	Both competitively issued currency and redemption medium coexist as media of exchange. Indirect redeemability. Banks set currency price of redemption medium.	Yes	System must coexist with conventional commodity of fiat standard 'Monetary disequilibrium' persists. Possibility of banking crises.
Competing Fiduciary Currencies Hayek (1978)	Competing inconvertible 'brand name' currencies. Flexible exchange rates between currencies. Issuers regulate currency issue via interest rate on loans and deposits of their currency	Yes	Stable price level(s). No resource costs. Possibility of banking crises.
Accounting System without a Central Bank. Black (1970) Fama (1980, 1983)	Medium of account is a commodity. Medium of account is directly tradable against asset(s) Banks are competitive mutual funds.	Yes	Payments occur via an accounting system. ¹ Price level determined by supply of and demand for medium of account. Payments system immune to banking crises.
Accounting System with a Central Bank.	As above; but medium of account is accounting liability of Central Bank.	Yes	As above; but Central Bank can determine price level via monetary policy.

2. Commodity Standards

2.1. A Commodity Standard with a Central Bank

Introduction

As we have noted, several of the proposed monetary systems considered are variants of a 'conventional' commodity standard⁸. This section therefore describes such a commodity standard in a general way and, further, outlines the adjustment process rendering such a system operational. Doing this allows us to establish more precisely how the proposed variants in fact differ from a 'conventional' commodity standard and, more importantly, whether they have any properties which distinguish them either from such a standard or existing fiat standards.

Description

We will take the defining characteristics of a commodity standard with a Central Bank to be:

- (i) that the national monetary unit (unit of account) is defined in terms of a given quantity of either a single commodity or some composite 'basket' of commodities⁹;
- (ii) that the Central Bank or Treasury is committed to exchanging this commodity, or composite commodity, for the national currency at the fixed price implied by the definition in (i),

⁸The primary historical example of such a regime, of course, is the gold standard (1820 - 1914).

⁹See Cooper (1982) for a discussion of the gold standard, and Beale, Kennedy and Winn (1942) and Friedman (1951) for discussions of composite commodity standards

- and this is the only channel by which currency is issued;
- (iii) that the Central bank is the sole issuer of the national currency, which consists of token paper or coin denominated in the monetary unit; and
- (iv) that prices are routinely quoted in terms of the defined monetary unit, and that currency as well as bank deposits convertible on demand into currency serve as the routinely used medium of exchange.

An obvious implication of (ii) is that, assuming no costs to exchanging the monetary commodity for currency (or vice versa) at the Bank or Treasury, there cannot be an independent, market-determined price for the monetary commodity. If there is only one good serving as the monetary commodity, as under the gold standard for example, agents in the gold market are price takers with respect to the currency price of gold. If more than one good serves as the monetary commodity, as under the composite commodity standards analysed by Friedman (1951), the individual prices of the goods comprising the standard bundle are free to vary but the price of the bundle itself (ie. the composite commodity) is not. As under a *symmetallic* standard, however, a rise in the currency price of any one of the components of the standard basket requires a fall in the prices of one or more of the other components of this basket. Any discrepancy between the 'market' and official price of the standard basket would result in a process of arbitrage consistent with alleviating this discrepancy.

Although contrary to experience under various commodity standards which have prevailed in the past, we will assume that the Bank or Treasury pursues a non-discretionary policy with

regard to the monetary unit; that is, it is believed that the monetary authorities will maintain their pegged price, and will always hold commodity reserves sufficient to this purpose¹⁰. This implies, in effect, that the Central Bank subsumes domestic economic objectives to the maintainance of gold convertibility and external (balance of payments) stability. Thus, a further characteristic of the commodity standard described here is:

(v) that the Central Bank does not grant accomodation to the banking system, and that Bank rate is not a monetary policy instrument.

This assumption is justified on the grounds that Central Banks under a commodity standard could, in any case, pursue independent domestic policy using Bank rate only within narrow limits and for short periods. As Keynes (1931:271) pointed out with regard to the gold standard, "if any country tried to maintain a higher [Bank] rate than its neighbours, gold would flow towards it until either it gave way or the international system broke down by its having absorbed all the gold in the world. And if it tried to maintain a lower rate, gold would flow out until either it gave way or had to leave the international system through having lost all its gold"

Note that banking regulations, in particular statutory reserve requirements, are not listed among the defining characteristics of the commodity standard described here. Although banks issue deposit liabilities convertible on demand into

¹⁰See Bordo and Schwartz (1984) for historical evidence of this. Clearly a major motivation for the alternative monetary systems considered by this paper is -- as the public choice literature tells us -- that this assumption is not justified.

currency issued exclusively by the Central Bank, and would typically be required to hold a fraction of their assets in the form of non interest-bearing stocks of currency or deposits at the Bank, we argue here that such statutory reserve requirements are irrelevant to the *operationality* of any banking system. Moreover, this holds irrespective of whether banks operate under a fiat or commodity standard, or whether or not banks have access to Central Bank accomodation¹¹.

If banks *do* have access to Central Bank accomodation they need only hold a minimal amount of currency for daily redemption purposes, since any large withdrawals of deposits can be met by borrowing from the Bank. Required reserves are thus unnecessary to banks as a source of liquidity. If banks, however, *do not* have access to accomodation, then required reserves are conventionally thought to be a source of liquidity in the event of large deposit withdrawals. This is clearly not the case: since they are legally 'required', these funds are not available as 'reserves'. Thus banks would still have to hold *excess* reserves to satisfy nett redemption outflows.

Klein (1974) argues that non-interest bearing required reserves, in this context, should be treated simply as a tax on banking firms¹². Due to the costs of foregone interest, we might

¹¹Klein (1974:442) also reaches this conclusion. As he points out, enforcement of the convertibility of bank liabilities into government currency is the governmental intervention relevant to operationality in this case.

¹²Fama (1983) argues that a demand for *inconvertible* currency for transactions purposes is sufficient to determine the price level,

expect banks to offer lower deposit rates and charge higher lending rates; that is, increase their 'spread'. This presumably leads to *less* intermediation by banks than would pertain in the absence of reserve requirements. In the system described here, therefore, we will assume:

(vi) that banks are not legally required to hold reserves but, given (v), voluntarily hold excess reserves. In the event of illiquidity banks must obtain access to currency by selling assets.

Operationality

Although the system described here assumes that token currency (and bank deposits) serves as the circulating medium, the convertibility undertaken by the Central Bank implies that the price level is determined *as if* the monetary commodity itself was the actual medium of exchange (McCallum 1989). As mainstream theory indicates, an excess supply of the monetary commodity implies an excess supply of currency and, through an increased demand for goods, a rise in the currency prices of goods in general (see for example Barro 1979). This result, however, holds *strictly* only in a one-good economy: it is legitimate to derive conclusions concerning the 'purchasing power' of the monetary unit only under the assumption that the relative prices of the goods comprising the price index used to measure this magnitude are constant. Although this is well known, conventional theory gives

given a well-defined supply of such currency. Required reserves, then, are unnecessary for a finite, determinate price level in such a system also.

the impression that no definitional problems are associated with concepts such as 'purchasing power' and 'the price level' and such terms are used without qualification. In order to maintain correspondence with the literature we draw attention to this caveat here but continue to employ these terms.

We can, then, express the relative price of 'goods in general' (which we denote as g) against the monetary commodity (which we denote as m) under a commodity standard as follows:

$$P_{gm} = \frac{P_{g\$}}{P_{m\$}} \quad (1)$$

where $P_{g\$}$ denotes the currency price of goods, and $P_{m\$}$ the official, fixed currency price of the monetary commodity. An excess supply of the monetary commodity would, due to an increase in the supply of currency and an increased demand for goods, be reflected in higher currency prices of goods and hence a lower relative value of the monetary commodity against goods¹³. According to received theory this would result in more of the monetary commodity being demanded, either for export or non-monetary uses, and less of it being supplied due to the decreased relative profitability of this activity. In the absence of further demand or supply 'shocks', the price level would rise until the value (or purchasing power) of the monetary commodity was equal to the

¹³Clearly an increase in $P_{g\$}$ simply implies that *on average* prices have risen. Individual prices over the relevant period, however, will rise by more or less than this average, or even change in the opposite direction to this average.

marginal cost of production (in terms of goods in general) of that commodity (McCallum 1989). A commonly cited advantage of a commodity standard, therefore, is its *presumed* tendency toward a predictable long-run value of the monetary unit; that is, its predictability depends largely on the predictability of the increase in the supply of the monetary commodity (Campbell and Dougan, 1986)¹⁴.

A further point can be made here as regards the interpretation attached to equation (1) above. Although prices are routinely quoted in the monetary unit, and currency and bank deposits denominated in this unit are the routinely used media of exchange, the authorities' commitment to exchange the monetary commodity for currency at the announced price ($P_{m\$}$) implies that bilateral exchanges of the monetary commodity for goods may well be acceptable to agents. Equation (1) indicates that the amount of the monetary commodity necessary to conclude such transactions (that is, the *price* of goods in terms of the monetary commodity, P_{gm}) would be *derived* from the currency prices of the goods purchased, $P_{g\$}$, and the official currency price of the monetary commodity, $P_{m\$}$ ¹⁵.

¹⁴It is well documented, however (see for example Cooper 1982), that the gold standard era was in fact characterised by considerable fluctuations in the price level due to changes in the supply of gold.

¹⁵As will become apparent, this point is crucial to the assessment of the proposals of Hall (1982) and Greenfield and Yeager (1983, 1989).

Conclusion

Commodity standards of the type described in this section are indeed operational in terms of our definition, as is supported by historical evidence. Although no composite commodity standard with a large number of commodities defining the monetary unit has existed, the above argument suggests that such a system, too, could be operational.

Some conclusions regarding the properties of a commodity standard as described here can now be drawn. According to Barro (1979:32), "in relation to a fiat currency regime, the key element of a commodity standard is its potential for automaticity and consequent absence of political control of the quantity of money and the absolute price level". This absence of control, however, implies that there is nothing in the rules of a commodity standard which can keep inflation at zero (or, for that matter, at any other level). Indeed, any unanticipated event that affects the market of the monetary commodity will affect prices under a commodity standard. On the basis of an empirical study, Meltzer (1986) concludes that 'risk' and 'uncertainty' (in the sense of Knight and Keynes respectively) for prices were greater under the pre-war gold standard than any subsequent regime¹⁶. Commodity standards also naturally have a higher resource cost than fiat standards, and we expect these costs to rise with the number of goods comprising the 'monetary' commodity (see Friedman 1951).

Bearing these properties in mind, we now turn our attention to

¹⁶Meltzer (1986) also finds that the change in prices is *more predictable* now than under earlier regimes, even though the expected change is larger.

the proposed variants of a commodity standard.

2.2. 'Variable' Commodity Standards

Introduction

The study by Meltzer (1986), as well as historical evidence provided by Cooper (1982) and Schwartz (1986), indicate that price stability did not in fact characterise the gold standard (1820 - 1914). Fisher (1912) thus proposed a variant of the gold standard which he called the 'Compensated' Dollar system. Such a regime, he claimed, would isolate the purchasing power of the monetary unit from "the chances of gold mining" (1912:502) and create "a standard monetary yardstick, a stable dollar" (1912:502).

Hall (1982, 1984) has recently revived Fisher's notion of a 'variable' commodity standard in the form of a proposal which he has called an ANCAP standard. Hall's regime differs from that forwarded by Fisher only in detail, and resembles closely a composite commodity standard as described in the previous section.

This section, after describing each of these proposals in turn, finds *both* systems to be operational, but finds *neither* to have the properties claimed for them by their originators or subsequent commentators.

2.2.1. The 'Compensated' Dollar

Description

Fisher's proposal modifies the specification of a commodity standard outlined in the previous section in one significant respect. Instead of exchanging the monetary commodity (ie. gold) for the national currency (ie. the paper dollar) at a *fixed* price, Fisher proposes that the monetary authorities "mark up or down the weight of the dollar (that is, ... mark down or up the [dollar]

price of gold bullion) in exact proportion to the deviation above or below par of an index number of [dollar] prices" (1912:498). This would ensure, according to Fisher, that one dollar of gold would "always buy approximately [a] composite basketful of goods" (quoted in Bordo 1984:53). Subsequent commentators (see Cooper 1988) thus argue that Fisher's scheme amounts to a 'tabular standard'; that is, it is similar in effect to a composite commodity standard, but has currency convertible only into a single commodity (ie. gold).

Under this scheme, then, the official dollar price of gold at any point in time, $P_{m\$}(t)$, is linked to a dollar price index via a policy feedback rule¹⁷, which we can express as follows:

$$P_{m\$}(t) = \frac{P_{m\$}(0)}{(1 + \alpha_t)} \quad (2)$$

where $\alpha_t = (CPI_t - CPI_0) / CPI_0$ is the fractional deviation of a consumer price index at time t from its value at some initial time $t = 0$, and $P_{g\$}(0)$ is the dollar price of gold at time 0, ie. when the index was at par.

Equation (2) indicates that a higher dollar price level at time t , since α_t is then greater than zero, is consistent with a proportionately lower official dollar gold price. In other words, when dollar prices rise, the authorities stand ready to redeem dollar-denominated currency for more gold than before and offer

¹⁷Black (1988) has recently described and endorsed a proposal for a gold standard with such a feedback rule.

less currency in exchange for a given amount of gold than before.

Operationality

Although recently endorsed by various commentators¹⁸ as a means of achieving price stability under a commodity standard, it is shown here that Fisher's proposal neither achieves this aim, nor does it in any sense 'compensate' dollar holders in the event of a higher price level.

Assume that a new ore discovery (ie. an excess supply of gold) precipitates, via an increased demand for goods, a rise in the dollar prices of goods. Equation (2) implies that this causes the monetary authorities to lower their announced dollar price of gold. Although agents can now purchase more gold per dollar of currency, this does not imply that they can still purchase the same basket of commodities per dollar of currency. This would be possible only if lowering the official dollar gold price immediately caused the dollar prices of goods to fall. There is no reason why this action by the authorities should, *in itself*, bring about this result in Fisher's regime.

Furthermore, if we recall equation (1) above, it becomes apparent that lowering the official dollar price of gold ($P_{m\$}$) after dollar prices in general ($P_{g\$}$) have risen accentuates -- rather than compensates for -- gold's loss of purchasing power against goods (P_{gm}). In other words, a given amount of gold now buys less goods than before not only because the prices of goods

¹⁸See Fama (1983), Black (1988), Cooper (1988) and *The Economist* (Jan 6 1990).

have risen, but also because a given amount of gold now buys less currency than before. In sum, the supposed 'compensation' of Fisher's rule does not help those agents who hold wealth in the form of currency or deposits, whilst it *penalises* those agents who hold wealth in the form of gold.

The upshot is that Fisher's variant of the gold standard, rather than compensate for changes in the purchasing power of the dollar, merely augments the 'automatic' price level adjustment (as outlined in the previous section) whereby non-zero excess demands of gold are eliminated under such a system. By accentuating the loss of purchasing power of gold (and so also its relative profitability) when the price level rises, we can expect a sharper fall in the supply of gold under this system than under the conventional gold standard. In terms of the discussion in the previous section, this could imply a faster elimination of the excess supply of or demand for gold than would have pertained otherwise. Alternatively, it could possibly imply unstable oscillations of the dollar price level. The equilibrating process however remains the same: prices of goods fall due to the lower demand arising from a reduction in the supply of gold.

As a variant of a conventional commodity standard Fisher's system is operational, but cannot avoid the price level consequences implied by non-zero excess demands for the monetary commodity under such a system. Since it neither isolates the monetary unit from the 'chances of gold mining'¹⁹, nor maintains

¹⁹This point becomes obvious if one considers Fisher's rule as a feedback rule - dollar prices 'in general' must rise *prior* to any adjustment in the official gold price.

the purchasing power of the monetary unit, the system does not have the properties ascribed ascribed to it by its originator.

In light of the caveat raised in the preceding section regarding 'purchasing power', a final point concerning Fisher's notion of 'compensation' should be made. We have noted the well known fact that index numbers simply express an *average* of dollar price variations, and tell us nothing about the *individual* dollar price variations of the goods comprising that index. Consequently, 'compensation' for changes in purchasing power based on this average, even if it could be achieved, would be *arbitrary* with respect to individual agents, since agents have different consumption bundles and are thus affected differently by these individual price variations.

2.2.2. The ANCAP Standard

Description

Unlike Fisher, Hall suggests that the dollar (the unit of account) be defined in terms of a 'resource unit' called the ANCAP, since it comprises specified quantities of ammonium nitrate, copper, aluminium and plywood. These commodities are chosen because, unlike gold, their combined purchasing power²⁰ has been historically stable. Defining the dollar in terms of this resource unit would, according to Hall, by itself "come close to stabilising the cost of living" (1982:115). Clearly this proceeds on the assumption that the conditions contributing to the

²⁰That is, their combined dollar value relative to some dollar price index like the CPI.

stability of the price of the ANCAP relative to the CPI will prevail into the future. Given the change of monetary regime that Hall is advocating, and the central role of the ANCAP in this regime, it is unclear whether this assumption is justified. This is, however, not a central issue for our analysis.

According to Hall, the resource unit itself would be designated as legal tender and "would replace dollar bills and the accounting entries [ie. bank deposits] currently serving as legal tender ... Of course, the physical resources would not actually circulate as currency " (1982:112). As McCallum (1985) points out, Hall does not specify what actually serves as the medium of exchange. Hall emphasises, however, that the government 'sets' the dollar price of the ANCAP resource unit, and that *market processes* keep the sum of the dollar market prices of the ANCAP commodities equal to the announced price. We can assume, therefore, that the government (Central Bank) is the sole issuer of dollar-denominated currency, it stands ready to exchange this currency for ANCAP's at the chosen price, and it holds reserves of ANCAPs sufficient for this purpose²¹. In the absence of such institutional arrangements it is difficult to see how the government could 'set' the dollar price of the ANCAP²² and, moreover, how this price could be adjusted over time according to

²¹Hall (1982) proposes that the government should *not* hold ANCAP reserves so as to prevent it from intervening in the ANCAP commodity markets. Clearly the government *must* hold some reserves in order to successfully set the dollar price of the ANCAP.

²²It is conceivable -- but unlikely -- that regulations be imposed on private banks to undertake convertibility of distinguishable bank notes into ANCAP's at a rate specified by the government.

some feedback rule (see below). As under a conventional commodity standard, banks issue dollar-denominated deposits convertible on demand into currency, which also serve as a medium of exchange.

Having specified these arrangements, it is apparent that designating ANCAPs as legal tender is a superfluous feature of Hall's proposal, since agents can always obtain the necessary 'dollars worth' of ANCAPs at the announced dollar price should anyone require them as payment. In other words, the price of goods in terms of ANCAPs is *derived* from their dollar price and from the official dollar price of ANCAPs in the manner implied by equation (1) in section 2.1. above.

Following Fisher, Hall proposes that the government adopt the following feedback rule for setting the dollar price of the ANCAP: "Each month, depress the dollar price of the resource unit by one-twelfth of the amount by which the most recent CPI exceeds the target level" (1982:118). Comparison with equation (2) above shows that this rule simply advocates smaller adjustments to the dollar price of the monetary commodity in response to a given price level change than does Fisher's, but is otherwise identical²³. Such a policy by the monetary authorities, according to Hall, "defines the dollar as enough resource units to buy the CPI basket at its most recently measured price" (1982:116) and implies that "the purchasing power [of the dollar] remains constant as time passes" (1982:115).

²³As Hall puts it, "apply Fisher's formula monthly at annual rates" (1982:118).

Operationality

As we noted above, the ANCAP standard described here is not fundamentally different from Fisher's 'compensated' dollar system, and is simply a variant of a conventional composite-commodity standard as described in section 2.1. Consequently, the system is operational according to the same argument as presented in that section. Hall, however, specifies the manner in which the feedback rule of the monetary authorities acts to maintain price stability, and this is discussed here.

Assume that the dollar price level rises above the 'target level' chosen by the authorities, and that the announced dollar price of the ANCAP is lowered accordingly. Hall argues that, under this scenario, "sellers who do not adjust their dollar prices downward will be asking for more resources in return for what they are selling. There will be an excess supply in all markets where prices do not fall immediately ... [and] thus the redefinition of the dollar puts downward pressure on ... prices in the economy" (1982:117).

Recall that agents routinely post prices in dollars, and routinely use dollar denominated currency and bank deposits as media of exchange. There is thus no reason why a lower dollar price for ANCAPs should impinge on the dollar pricing decisions of agents in the manner suggested by Hall. Sellers of goods, by not lowering their dollar prices, are indeed demanding more ANCAPs for their goods. They will not, however, experience excess supplies of their goods, because the lower official dollar price of ANCAPs is consistent with sellers demanding more ANCAPs for any given dollar price of goods. As stated above, the authorities'

commitment to redeem currency for ANCAPs at an officially set dollar price implies that agents can always obtain the ANCAPs corresponding to a given 'dollar worth' of goods should they be required to pay with ANCAPs (recall that ANCAPs are legal tender).

Lowering the dollar price of the ANCAP when the price level rises, then, does not amount to redefining the dollar as enough resource units to buy some standard commodity bundle. Just as in Fisher's system, this action by the authorities can, in itself, do nothing to 'compensate' agents for the lower purchasing power of dollar denominated media of exchange, whilst it penalises agents holding wealth in the form of ANCAPs. The lower dollar price of ANCAPs simply initiates the equilibrating process (of falling prices of goods due to a reduction in the supply of the monetary commodity) that characterises commodity standards in general.

Conclusion

As we have shown, a 'variable' commodity standard along the lines suggested by both Fisher and Hall is operational via the same adjustment process as that under a conventional commodity standard. Irrespective of whether the official currency price of the monetary commodity is fixed or variable according to some feedback rule, non-zero excess demands for the monetary commodity imply that the currency prices of goods in general will adjust to eliminate this. The purchasing power of the monetary unit in either system, then, does not remain constant over time. As it is not clear whether the price level can be either more stable or more predictable if the authorities vary (rather than keep constant) the official price of the monetary commodity, such

regimes do not have any properties making them intrinsically preferable over conventional commodity standards or, according to the conclusions in section 2.1., over existing fiat standards.

We turn now to proposals which retain convertibility of the medium of exchange into some commodity, but which assign this role to private, competitive banks rather than a Central bank.

2.3. A Commodity Standard with 'Free' Banking

Introduction

The term 'free banking' has conventionally been used to describe periods in monetary history supposedly characterised by relatively unregulated banking, with the two primary examples being the United States between 1837 - 1863 (Rolnick and Weber 1988) and Scotland between 1800 - 1834 (White 1984a). As Klein (1974) points out, this term is somewhat of a misnomer since the distinguishing feature of these periods was relatively *unrestricted entry* into banking, as opposed to *unregulated banking*. Both in the U.S. and Scotland (see McCallum 1989 and Cowen and Kroszner 1989 respectively) there were numerous 'free banking laws' circumscribing the activities of private banks²⁴. Amongst others, these included regulations concerning statutory bond deposits, reserve requirements, the printing of bank notes, stockholder liability and par redemption.

Clearly the specific legal restrictions imposed during the free banking era differed from place to place, and thus affected the development and activities of financial intermediaries in different ways. The common feature, however, of this period seems to have been the presence of distinguishable, privately issued bank notes (and deposits) convertible on demand into a specified amount of specie (silver or gold). Free banking systems, therefore, have historically been commodity standards in which

²⁴So much so that Cowen and Kroszner (1989) question whether the Scottish experience was indeed one of 'free' (ie. laissez-faire) banking

convertibility of currency into the monetary commodity was undertaken by private banks rather than a Central Bank or Treasury. The absence of any historical example of the private production of purely inconvertible fiduciary currencies²⁵ has led White (1983) to claim that "free banking on a specie standard is the most plausible monetary system free of government involvement" (1983:291). Given that he has been the major proponent of such a system as a potential alternative to existing fiat currency systems, the free banking system specified in this section is drawn mainly from his contributions to the literature (see White 1983, 1984, 1984a, and Selgin and White 1987). For purposes of simplification, the specification here does not incorporate the numerous place-specific regulations which were present in actual free banking systems in the past unless these are integral to the operability of the system.

This section finds a commodity standard with 'free' banking to be operational. It emerges that such a system has very similar price-level properties to a 'managed' commodity standard. Although proponents of 'free' banking hold that it is inherently preferable to a 'managed', regulated monetary system this claim is, as yet, made without theoretical validation.

Description

We begin by assuming an economy where, either due to historical evolution or government decree, there exists a monetary

²⁵Both Klein (1974) and Friedman and Schwartz (1986) acknowledge that they are unaware of any historical examples of such monetary arrangements.

unit called the dollar, which is defined in terms of a specified amount of gold. The government does not issue any claims (currency) denominated in dollars, designate anything as legal tender, or take any action to affect the purchasing power of the monetary unit. All details of organisation of financial intermediaries²⁶ are under the control of the private sector and, following White (1984), we elaborate these below.

We assume that banks issue distinguishable bearer notes which they promise to convert, on demand, into the amount of gold specie corresponding to their dollar denomination. They also issue checkable deposits, which bear competitively determined interest rates, and are convertible on demand into either notes or specie²⁷. Against these liabilities, we assume that banks hold assets consisting of gold specie, interest-earning loans and commercial paper, and equity.

Dowd (1988) argues that competition between banks *forces* them to offer liabilities in the form of a convertibility contract (notes and deposits convertible into gold) since offering inconvertible liabilities does not represent "a *credible* assurance that such notes and deposits would *retain their value*" (1988:25, emphasis added). This argument, which is commonly invoked among the proponents of free banking, must however be qualified on two counts.

²⁶Banks, then, are bound by the law of contract only, and are not subject to any 'special' legislation (see Selgin 1988)

²⁷Clearly banks may also issue notice and time deposits as they do today.

Firstly, the assurance of convertibility does not, by itself, establish the credibility of a contract (such as a bank note), since it is always possible that the issuing bank will renege on its promise. Rather, a contract becomes credible once agents expect -- or trust -- that the assurance will be maintained in the future. A bank note should be considered credible because agents trust that the issuing bank will *not* suspend convertibility, and not simply because the issuing bank *offers* convertibility. Credibility, then, is derived from the past performance and expected future behaviour of the issuing bank, and not convertibility *per se*. To use Klein's (1974) terms, offering convertibility is *one way* a bank can establish consumer confidence in the currency it issues, and should be seen as *part of* that bank's investment in 'brand name capital'.

Secondly, it is a misconception that a bank note that is convertible into gold represents a promise by the issuer to uphold the *value* (purchasing power) of that note. Being a promise to pay a fixed amount of gold, the purchasing power of a bank note is (as we described in section 2.1. above) ultimately determined by the supply of and demand for gold. Convertibility cannot guarantee the purchasing power of a note if there exists (say) an excess supply of gold since, under these circumstances, we would expect the prices of goods in general to be rising.

White (1984) and Selgin and White (1987) suggest several reasons why a competitive banking environment would lead banks to accept each other's notes at par and, further, to settle interbank obligations via a centralised clearinghouse arrangement.

Historical evidence seems to support these arguments²⁸. We will assume, then, that banks contractually agree to accept -- at par -- the notes and deposits of the other member banks of a clearinghouse arrangement. Although gold specie is the ultimate settlement or clearing asset among member banks, various other assets may ordinarily be acceptable to banks for clearing purposes.

The above arrangement implies, in effect, that a bank stands ready to redeem not only its own notes and deposits for gold, but also those of its competitors. Should the public decide that a particular bank has become too 'risky' and either redeem their notes for gold or exchange them for the notes of another bank, the costs of the risky bank failing will be borne largely by the other member banks. We will assume, therefore, that the clearinghouse monitors the 'soundness' (or solvency) of each member bank to assure the other members that its notes and deposits are safe to accept for clearing. Failure to comply with the clearinghouse's definition of 'soundness' results in a bank being expelled from the arrangement, a clear negative signal concerning the bank's ability to redeem its liabilities. In the event that agents 'run' on such a bank because they perceive it to be illiquid, the bank may be forced to incur such substantial losses from selling its assets that it is ultimately rendered insolvent.

Finally, then, we assume that the clearinghouse arrangement provides a source of reserves to banks experiencing liquidity

²⁸See Mullineaux (1987), Gorton and Mullineaux (1987) and Rolnick and Weber (1988).

problems. Clearly the arrangement serves as a medium through which member banks can lend to temporarily 'illiquid' banks. Furthermore, the clearinghouse itself may issue loan certificates which banks could borrow and use in place of specie in the clearing process²⁹.

Operationality

As we noted above, the system specified here can be thought of simply as a gold commodity standard in which the convertibility of currency into gold is undertaken by private, competitive banks rather than the Central Bank or Treasury. Price level determination in terms of the unit of account occurs via the same process that was outlined in section 2.1. above, and White (1984) demonstrates that the system specified here is operational³⁰. Historical experiences in both the U.S. and Scotland support this result.

One issue which should be addressed here, however, is the notion of 'overissue': as Gorton (1985) points out, the most common criticism of free banking is that private banks in the above system would 'overissue' banknotes in the sense that their actions would lead to the depreciation of these banknotes (ie. a

²⁹See Timberlake (1983) and Gorton and Mullineaux (1987) for evidence of this

³⁰White's objective is to "examine generally the operation of a free banking system, seeking to discover whether the self-interested actions of individual agents in that system give rise to equilibrating ... processes" (1984:278 emphasis added) which, in our opinion, he shows to be the case with free banking.

higher price level). White (1984) and Dowd (1988), however, correctly stress that *convertibility* imposes a constraint on competitive banks to 'overissue' notes in this sense. While private banks can costlessly *initiate* the circulation of their notes, either by lending or 'spending' their notes into circulation, they cannot costlessly *maintain* the circulation of these notes given their commitment to *convertibility* of these notes into specie. Unless banknotes are *willingly* accepted and held by the public they will be returned to the issuing bank for redemption, either by noteholders directly or via the clearinghouse arrangement described above, thus draining the specie reserves of the issuing bank.

Pursuing a strategy of deliberately issuing more and more notes, then, implies that the issuing bank will exhaust its specie reserves, have to borrow reserves from other members of its clearinghouse arrangement, and eventually face expulsion from that arrangement. Such a strategy is clearly not profitable to an individual bank in this system. In order to expand its note issue, therefore, a private bank must engage in (costly) activity which increases the *demand* for the notes it issues³¹. Using Klein's (1974) terminology, a bank must invest in 'brand name capital' in order to increase consumer confidence in, and hence the acceptability of, its notes.

This result, that banks issuing notes and deposits

³¹This may include, amongst other things, longer operating hours, additional branch offices, more extensive advertising of these services and, as in Klein (1974), the payment of explicit interest on banknotes.

convertible on demand into specie cannot 'overissue' these liabilities, also holds for the system as whole. If banks jointly choose to expand their note issue they would not face adverse clearing accounts amongst each other, but rather to banks 'outside' their region. This occurs because any tendency for currency prices to rise in response to this joint expansion is countered by outflows of notes and/or specie from the region as agents 'import' goods from elsewhere. Thus there is a drain on the specie reserves of the system as whole, as agents either directly redeem their notes for specie to purchase 'imports', or banks outside the region return notes for redemption.

Conclusion

A 'free' banking regime in which private, competitive banks provide a medium of exchange convertible on demand into some commodity is operational, as White (1984) has shown. This result is not surprising in so far as the system specified here closely resembles a commodity standard with a Central Bank (ie. a regime in which a single agency issues convertible currency). Proponents of free banking, however, argue that its advantage over a monetary system with a Central Bank is the development of institutions under free banking which protect the banking system against 'shocks' (such as systemic bank runs) and make it inherently more 'stable' than it is, and has been, under regulation (see for example Dowd 1988a). This view is countered by theorists who argue that 'free' banking systems nonetheless have features which make regulation and supervision unavoidable if systemic financial crises are to be averted (see Goodhart 1989). Theory is not yet

conclusive on this issue, and it is not clear that 'free' banking systems have the property of inherent 'stability' (ie. the absence of systemic financial crises) as claimed by their proponents. This suggests that the properties making a free banking system preferable over existing fiat systems derive from the former being a commodity standard regime, rather than a regime without a Central Bank.

Under a commodity standard the supply of currency, whether it is issued by a Central Bank or competing private banks, is ultimately governed by the supply of the monetary commodity. Similarly, the price level in both these systems is determined by the supply of and demand for the monetary commodity. Seen from this perspective, the price-level properties of a free banking regime are essentially the same as those of a commodity standard with a Central Bank³². The greater 'risk' and 'uncertainty' for prices under the gold standard (see Meltzer 1986), as well as the resource costs associated with a commodity standard, suggest that the regime described in this section does not have any properties making it preferable over a 'managed' fiat standard.

We turn now to the final proposal that is a derivative of a commodity standard. Although it is a 'free' banking regime, it also encompasses features of the variable commodity standard discussed in section 2.2. of this chapter, and is claimed to achieve a stable price-level as well as eliminate 'monetary disequilibrium'.

³²As Hall (1982a:1553) notes, "[U]nder a gold standard ... deregulation would affect the price level only to the extent that it changed the supply of or demand for gold".

2.4. The BFH System

Introduction

This section examines a proposal, put forward by Greenfield and Yeager (1983, 1989; hereafter G&Y)³³, which may be summarised as a combination of the free banking system and the variable commodity standard(s) described above. Called the BFH system³⁴, G&Y's proposal stems from their concern with two inter-related aspects of (past and) present monetary regimes. The first is that "our existing monetary system is absurd in having a unit of account whose size (purchasing power) is the supply and demand determined value of a fiat medium of exchange" (1989:6). Economic calculation and coordination are clearly impaired by the presence of such an 'unstable' unit of account. The second, and related, 'absurdity' concerns the manner in which the supply and demand for the medium of exchange interact in adjusting its value. In particular, "since monetary disequilibrium cannot be corrected by a straightforward adjustment of a single price ... its correction requires adjusting myriads of separate but interdependent prices on myriads of separate markets" (1989:6).

The solution to these problems, according to G&Y, lies in 'separating' the unit of account from the medium of exchange, where 'separation' means "that the unit [of account] is defined independently of any particular medium of exchange. Various media hitch onto the unit" (1989:18). The BFH system, then, represents

³³See also Yeager (1983, 1985 and 1989).

³⁴After ideas taken from Black (1970), Fama (1980) and Hall (1982).

a monetary system which presumably achieves this 'separation', and purportedly has the following properties:

(i) it would be rendered operational by banks' natural adoption of 'indirect convertibility' (see below), and

(ii) it would eliminate the above problems from a monetary economy.

We show, however, that the BFH system as specified by G&Y is non-operational and, further, that the assumptions necessary to satisfy (i) in fact preclude the satisfaction of (ii). In other words, if the BFH system is operational it has no properties which make it superior either to a conventional commodity standard or existing fiat standards.

Description

Let us ignore any transitional problems and assume that the BFH system is in operation. The government has defined a unit of account (which G&Y call the *Unit*) in terms of a specified bundle of commodities (which we denote as *b*), and this Unit is routinely used by agents to quote prices. The government does not designate anything as legal tender and does not issue currency denominated in Units.

Private banks issue distinguishable bank notes denominated in Units as well as deposits convertible into these notes, and we assume that these are the sole media of exchange in our economy. According to G&Y, these BFH banks naturally choose to uphold the exchange value of their notes and deposits via 'indirect

convertibility'³⁵. This means that banks stand ready to redeem each Unit of their notes and deposits into some redemption medium (which, without loss of generality, we assume is gold and denote here as g) in an amount whose exchange value at existing market prices is equal to that of the standard bundle, b , of commodities. This amount of gold "would be calculated each month (day) from the open-market price of gold and from the prices of the various goods in the bundle" (Yeager 1983:323, emphasis added)³⁶. Notice that the amount of gold banks are prepared to redeem for their notes and deposits represents a gold price and thus that there are, in effect, two prices for gold in terms of Unit currency. G&Y's specification implies that banks 'derive' their gold price in terms of Unit currency, P_{gu}^B , from the market price of gold in terms of Unit currency, P_{gu}^M , via the rule:

$$P_{gu}^B = \frac{P_{gu}^M}{P_{bu}} \quad (3)$$

where

$$P_{bu} = \sum_{i \in b} P_{iu}$$

and where the bundle (for simplicity) consists of one unit of each

³⁵While there are reasons why so-called free banks may be compelled to offer par convertibility, there is no apparent reason why competitive banks would naturally adopt a convertibility rule such as the one outlined below.

³⁶Since Unit-denominated notes and deposits are the only media of exchange, the "prices" referred to here must be Unit prices.

good $i \in b$, b is the set of goods included in the standard bundle, and P_{i_u} denotes the price (per unit) of the goods $i \in b$ expressed in Units³⁷.

Before turning to the operationality of this system, we should note an apparent inconsistency in the way G&Y think that the value of the Unit will be maintained. According to an earlier paper, the commodity bundle "would, by definition, have the fixed price of 1 Unit" (1983:303, emphasis added). In terms of our description above, this implies that the Unit-price of the standard bundle, P_{bu} , would take on a value of one Unit 'by definition'. This is inconsistent with G&Y's later acknowledgement that "the total price of the BFH commodity bundle ... [can] deviate from the one corresponding to the definition of the Unit" (1989:13).

The presence of indirect convertibility in G&Y's system provides the means whereby the Unit's value is supposed to return to its 'definition' in the event of such a deviation. Clearly if the price of the standard bundle is one Unit 'by definition', there is no need to invoke any convertibility rule in order to uphold this price. Let us assume then that definition alone is not sufficient to maintain the Unit's value, and evaluate the indirect convertibility process.

³⁷Greenfield, in correspondence, has pointed out a dimensionality problem with equation (3). Clearly there are two prices for gold in terms of Units, with one being 'derived' from the other - hence the problem. Of course, this is G&Y's specification, not ours.

Operationality

Our procedure for analysis will be to allow non-zero excess demand to arise for some good $i \in b$ (which implies that the Unit price of the bundle deviates from one) and then to consider whether the BFH banks' automatic reaction by equation (3) above will maintain the Unit's value. Yeager (in correspondence) contends that this analytical procedure ignores the distinction between banks (plural) and the individual bank in the BFH system, and posits that indirect convertibility should be seen primarily as a rule disciplining individual banks. He argues that a bank which 'overissues' notes (and deposits) will drive the price of the Unit-defining bundle above one *in terms of its own notes*. The prices of gold and the commodities in the bundle would be measured in Units, but this is equivalent to "measuring them in Unit-denominated banknotes of banks that were maintaining their issues at their full denominated values". Indirect convertibility, then, serves to impose a 'penalty' on the over-issuing bank, since it now has to redeem its notes and deposits for more gold than all other BFH banks (ie. only the 'misbehaving' bank lowers its gold price in terms Units). Given that individual banks face this penalty for 'overissue', Yeager claims that they avoid doing so and thus "for the system as whole, the question is forestalled of what happens if prices ... generally rise out of correspondence with the bundle definition of the Unit".

Yeager's argument, however, is problematic. As we have noted in section 2.3. above, banks cannot 'overissue' liabilities which they promise to redeem for gold. Convertibility itself is the constraint on overissue, since any banknotes which are not

willingly held by the public are returned³⁸ to the issuing bank for redemption into gold, and thus that bank will find itself losing reserves of the redemption medium. The fact that they offer convertibility implies that BFH banks would not be able to drive up the price of the Unit-defining bundle in terms of their own notes. There is, however, a more compelling reason as to why this would not occur in the BFH system. Sellers who were faced with positive excess demand (for whatever reason) for their goods would raise the Unit prices of these goods: that is, they would ask for more notes or deposits in exchange for their goods *irrespective* of the issuing bank. Given that banknotes and deposits are all denominated in Units, and are convertible into gold according to the same rule, there is simply no basis for agents to accept them at anything other than their denominated value, or for sellers to charge different prices for the goods they sell according to which banks' currency is tendered. The possibility that the price of the Unit-defining bundle differs across currencies thus never arises in the BFH system as specified by G&Y. Yeager's emphasis on the distinction between banks and the individual bank is therefore superfluous, since any disturbance to price of the Unit-defining bundle implies that *all* banks respond in the way implied by equation (3) above. Our procedure for analysing the operationality of the BFH system is clearly consistent with this result.

Recall, then, that G&Y claim that indirect convertibility via the rule specified by (3) provides a mechanism whereby some (or

³⁸Either via direct redemption or, if agents deposit the notes with other banks, via the clearing process.

all) P_{iu} , $i \in b$, will adjust to restore P_{bu} to its 'definitional' price of 1 Unit whenever it deviates from this price. Such a deviation would occur whenever non-zero excess demand arises for some good $i \in b$.

When P_{bu} differs from 1, equation (3) indicates that the banks' price for gold will differ from the market price, and an opportunity for arbitrage is created. For instance, $P_{bu} > 1$ implies that $P_{gu}^B < P_{gu}^M$, and agents can 'round-trip' by redeeming notes for gold and selling this gold in the market, driving the market gold price down. A falling market price for gold implies, by equation (3), that the banks' price of gold must move in the same direction, as an increasing amount of gold is now needed to 'purchase' the standard bundle.

According to G&Y, "to engage in such arbitrage, people would try to obtain notes and deposits for redemption by exhibiting reduced eagerness to buy goods and services and increased eagerness to sell them, all of which would put appropriate downward pressure on the general price level and on the total price of the standard bundle" (1989:14).

This is surely incorrect. This riskless arbitrage opportunity does *not* imply increased demand for notes and deposits for redemption purposes. Agents would simply buy gold from the banks (redeem notes) and *simultaneously* sell gold in the market to realise a gain, and would not require 'additional' notes and deposits for such transactions. More importantly, there is nothing in this arbitrage process which implies negative excess demands for goods in general, including those in the Unit-defining

bundle³⁹. Consequently, there is no mechanism for inducing the required (downward) changes in the Unit prices of the goods comprising the standard bundle in order to restore the definition of the Unit. This arbitrage process thus drives both the market and banks' gold price to zero, or terminates when the banks renege on their rule due to insufficient gold reserves⁴⁰.

The upshot is that unless G&Y can specify why the arbitrage process should induce the necessary adjustment in the Unit prices of the goods comprising the standard bundle when $P_{bu} \neq 1$, their rule for indirect convertibility renders the BFH system non-operational. The major cause of trouble in G&Y's proposal arises from there being two prices for gold (the redemption medium) in terms of Unit currency. Clearly gold -- or redemption media in general -- cannot have a market price in terms of Unit currency which is *independent* from that specified by BFH banks. Unfortunately, this feature is central to G&Y's specification of the BFH system and its supposed 'separation' of the unit of account from the medium of exchange.

With different assumptions, however, it is possible to describe a variant of the BFH system which avoids the operationality problem above, and it is to the description of this system that we now turn.

³⁹If anything, we can expect *positive excess demands* for goods, and thus *rising prices*, since agents clearly profit from such arbitrage and so increase their wealth.

⁴⁰If $P_{bu} < 1$, the arbitrage process implies that both gold prices rise to infinity.

A BFH Variant

Assume now that gold exists *alongside* Unit banknotes and deposits as a generally accepted medium of exchange. Thus the exchanges which are routinely occurring are bilateral sales or purchases of goods for either gold or Unit notes and deposits, and agents quote both a gold price (expressed in ounces) as well as a Unit price for their goods. This then enables BFH banks to observe market prices of the goods in the Unit-defining bundle in terms of *gold*, and to operate under the modified rule:

$$P_{gu}^B = \frac{1}{\sum_{i \in b} P_{ig}} \quad (4)$$

where P_{ig} denotes the market price of good i in terms of ounces of gold and P_{gu}^B denotes the banks' price for an ounce of gold in terms of Unit currency. Comparison with equation (3) above shows that this rule, *if it can be adhered to*, would maintain $P_{bu} = 1$. Notice that this rule, in contrast to (3), assumes that there is no independent market gold-for-Unit price P_{gu}^M ; in other words, and more plausibly, market agents are price takers of the banks' determined value P_{gu}^B ⁴¹.

Operationality

Our procedure for analysis, as before, is to consider how

⁴¹The Unit price of gold, P_{gu}^B , can be considered as 'market determined' only in the sense that banks *derive* this magnitude by observing the amount of gold necessary to buy the Unit-defining bundle at market prices (expressed in ounces of gold).

agents set about changing prices when non-zero excess demand arises which requires price changes (i) in the market for a good which is included in the Unit-defining bundle, and (ii) in the market for the redemption medium, which in this case is gold.

(i) Non-Zero Excess Demand For Some Good $i \in b$

Suppose that a supply failure causes a positive excess demand for some good $i \in b$ to occur, whilst other markets remain undisturbed. Given the prevailing P_{gu}^B , the response of agents in this market must be to raise the price of i relative to both Unit-denominated currency and gold, ie. to the new prices $P'_{iu} = \alpha P_{iu}$ and $P'_{ig} = \alpha P_{ig}$, where $\alpha > 1$ ⁴². Since $i \in b$, equation (4) implies that banks now respond by reducing P_{gu}^B to its new value corresponding to P'_{ig} . This implies in turn that agents in all markets j , including market i , must now either raise P_{jg} or lower P_{ju} or perform some combination of these two actions in order to realign their prices with the new value of P_{gu}^B . If agents react by only raising P_{jg} the system is obviously not operational since this will only cause further reductions in P_{gu}^B . Hence we must *assume* that some agents for the goods $j \in b$ make some of the adjustment to the new P_{gu}^B by reducing their respective Unit prices, P_{ju} . This would ensure eventual convergence of Unit prices back to the condition $P_{bu} = 1$.

For this process to work it is therefore necessary, firstly, that market prices P_{ig} for goods in terms of gold are observable and, secondly, that agents make at least some of the adjustment to

⁴²This price rise implies that good i has also become more expensive against all other goods.

changes in P_{gu}^B by appropriate changes in P_{iu} rather than P_{ig} . Both of these conditions rely on the continuing presence of gold (the redemption medium) as a generally accepted medium of exchange. If Unit-denominated notes and deposits are the sole medium of exchange, BFH banks must make their calculations of P_{gu}^B from observations of P_{iu} and P_{gu}^M by equation (3) above which, as we have shown, leaves the system non-operational. Furthermore, if Unit-denominated notes and deposits are the only medium of exchange, there is no reason why agents in markets for goods other than gold should be influenced in their choices of the Unit prices they post by changes in P_{gu}^B .

(ii) Non-Zero Excess Demand for Gold (The Redemption Medium)

We have shown that our variant of the BFH system is operational only if gold continues to exist in parallel with Unit-denominated notes and deposits as a medium of exchange. The determination of the prices of goods in terms of gold clearly occurs in the same way as under the commodity standard described in section 2.1. above. As outlined there an excess supply of gold implies positive excess demands for goods, which in turn results in the prices of goods in terms of gold rising and gold becoming cheaper relative to goods. To use G&Y's terminology, 'monetary disequilibrium' cannot, in this case, be corrected by adjusting a single price in a single market, but only by a general adjustment in all prices.

Under our variant of the BFH system, then, an excess supply of gold implies a general increase in the gold and Unit prices of commodities given the existing P_{gu}^B . This would then induce changes in P_{gu}^B and, via the process described above, induce the

appropriate changes in the Unit prices of commodities such that $P_{bu} = 1$ again. The relevant point here is that non-zero excess demands for gold cannot be eliminated via the adjustment only of a single price, P_{gu}^B , since agents in the gold market are price takers with respect to the Unit-currency price of gold. Gold can only become cheaper relative to Unit-currency by *first* becoming cheaper relative to goods in general; that is, via the 'roundabout and sluggish' adjustment in prices which G&Y are trying to avoid with their proposal.

Conclusion

The motivation for the BFH proposal is that it eliminates certain problems from a monetary economy, which is to be achieved via 'separation' of the unit of account from the medium of exchange; in other words, defining the unit of account in terms of a bundle of commodities. This system is supposedly rendered operational by the 'indirect convertibility' of competitively issued currency into some redemption medium like gold.

It was found, however, that unless this redemption medium itself is a routinely used medium of exchange, such a system is not operational. A BFH system therefore can -- at best -- only *coexist* with a conventional monetary system whose unit of account and medium of exchange are *not* separated (such as a conventional commodity or fiat standard) and even then it cannot avoid the 'painful monetary disequilibrium' motivating this alternative system.

This concludes our consideration of proposals for alternative monetary regimes that are derivatives of a commodity standard. We

turn our attention, in the following chapters, to alternative monetary regimes which propose deregulation of the financial system but do not feature the convertible currencies associated with a commodity standard.

3. Competitive Fiduciary Currencies

Introduction

The common argument⁴³ against competition among private issuers of fiduciary currencies has been that such an arrangement would eventually degenerate into a 'paper standard' without any finite price level, since as long as a competitively issued fiduciary currency has an exchange value exceeding its cost of production an individual issuer has an incentive to issue additional amounts. Klein (1974) was the first to point out that this argument proceeded on the assumption that currency issuers were competing in the production of an indistinguishable, homogenous product⁴⁴. The conclusion above, therefore, did not derive from any 'special' characteristic of fiduciary currency but from the fact that indistinguishability of the output of competing firms would lead to product quality depreciation in any industry⁴⁵.

Stated differently, the contention that competitive equilibrium in the fiduciary currency industry implies an infinite price level assumes that the competing currencies are convertible into each other by issuers at unchanging fixed exchange rates. Competition would lead each issuer to inflate at a higher rate.

⁴³See for example Friedman (1959) or Pesek and Saving (1967).

⁴⁴Note that Thompson (1974) also points out this result in connection with competitive fiduciary currencies, albeit in a different context. Indistinguishability, he argues, violates the private property condition of orthodox value theory.

⁴⁵Competing firms have incentives to depreciate the quality of an indistinguishable product since the costs of such actions will be borne mainly by other firms in the industry (see Klein 1974:430).

than other firms, implying the standard result that 'bad monies drive out good monies'. Klein argued that distinguishable, 'brand name' currencies were *necessary* for the competitive provision of fiduciary currency and, if these exchanged with one another at market determined *flexible* exchange rates, currency issuers would not act so as to depreciate these currencies. Briefly, competitive currency issuers would invest in brand name capital (ie. increase the confidence in, and acceptability of, their currency) by successfully keeping the rate of currency issue equal to the rate anticipated by the public. In such a scenario, 'high confidence' currencies would drive out 'low confidence' currencies.

Klein's (1974) paper, however, does not argue that a competitive currency regime has properties which make it preferable over 'managed' fiat regimes, but is concerned rather with elaborating the theoretical properties of such a regime consistent with the assumption that competitively issued currencies are distinguishable. Klein notes that historical examples of such regimes are extremely rare, and rationalises the (monopoly) role of government in the provision of currency. The proposal for competing fiduciary currencies as an alternative monetary regime is thus attributed to Hayek (1978, 1984), who argues that "[T]he past instability of the market economy is the consequence of the exclusion of the most important regulator of the market mechanism, money, from itself being regulated by the market process" (1978:98). Hayek proposes, therefore, to "do away altogether with the monopoly of government ... money and to allow private enterprise to supply the public with other media of exchange it may prefer" (1978:22).

Hayek's specification of the banking institutions supplying these media of exchange has been criticised as being "remarkably vague" (Fischer, 1986:433). As we outline below, banks can implicitly adopt two distinct operating procedures for maintaining the purchasing power of the currencies they issue. Although both of these operating procedures are consistent with the operationality of a competitive fiduciary currency system, one is found to be implausible under this regime. The argument that such a regime is preferable over existing regimes, however, must turn on the prior belief that competitive outcomes are necessarily superior to those obtaining in a regulated but 'well managed' monetary system.

Specification

Let us assume, to begin with, an economy with a monetary regime corresponding to the fiat standards we currently observe. The role of a Central Bank is to issue fiat currency by standing ready to lend it to the banking system at some nominal interest rate (which is set by the Bank at a level it presumes is consistent with its monetary policy objectives). Fiat currency, as well as bank deposits convertible on demand into fiat currency, are the routinely used media of exchange, and all prices and contracts are expressed in this currency. Let us name this fiat currency (and hence also the unit of account) the dollar.

Assume now that all regulations relating to the currency monopoly of the Central Bank are removed. Although it continues to issue dollar currency as before, the Central Bank has become an issuer of *fiduciary* rather than *fiat* currency. Since there are no

longer any 'special' legal restrictions distinguishing banks from any other firms, and agents are free to use any currency for expressing prices and contracts, some private banks will want to issue their own distinguishable currencies, and agents who believe such currencies will provide a stable unit of account or store of value (say) will adopt them for these purposes. •

Although seemingly unaware of the fact, Hayek proposes two distinct procedures whereby private banks would initiate and maintain the circulation of their (uniquely denominated) notes and deposits, and we specify each in turn. We differentiate the procedures by naming the currency as 'ducats' (Hayek 1978), in the first case, and as 'solids' (Hayek 1984) in the second. As is explained below, the 'ducat' issuer's operating procedures are essentially the same as that of any existing Central Bank, whilst the 'solid' issuer is essentially a BFH bank as already analysed in section 2.4. above.

According to Hayek (1978), a bank wishing to issue ducat denominated notes (and deposits⁴⁶) could do so either by *lending* them at some nominal (ducat) interest rate, or by standing ready to *exchange* them, now and in the future, for some *minimum* price in terms of dollars. This minimum would be intended "only as a floor below which the value of the [ducat] could not fall because [the bank] would announce at the same time [its] intention to regulate the quantity of ducats so as to keep their ... purchasing power as nearly as possible constant" (Hayek, 1978:42). The sale of

⁴⁶Note that these are now irrevocable claims to *ducat* currency only.

currency would thus be the chief form of initial issue but, after a regular market in that currency is established, it would be issued predominantly by lending at interest. In order to alter the volume of its notes and deposits (and hence their purchasing power) the ducat issuing bank must change the interest rate it charges for loans (and offers on deposits), in the same way as is done by existing Central Banks⁴⁷.

An alternative operating procedure for a new currency issuer, whose currency unit we shall call the 'solid', can also be found in Hayek (1978, 1984). Such a bank would issue its liabilities either by lending them at some chosen nominal interest rate, or by standing ready to redeem solids "in such amounts of other currencies as would be required at any time to buy the whole collection of different raw materials defining ... [the solid]" (Hayek, 1984:328; emphasis added). The latter rule implies that the issuing bank must "stand ready to buy and sell at the stated rates any amount of such units [ie. solids] that might be offered to or demanded of it" (Hayek, 1984:331), and thus the bank sets the exchange rate (now and in the future) between solids and dollars. This description also indicates that the solid-issuing bank is formally identical to a BFH bank in our variant of the BFH system developed in section 2.4. above: although the redemption medium in this case is dollar currency rather than gold, the rule whereby the solid-issuing bank maintains the purchasing power of

⁴⁷Given the institutional arrangements under existing fiat standards, Bank rate is the *only* policy instrument at the disposal of Central Banks (see Whittaker and Theunissen 1987 or Moore 1989).

its currency is clearly the same as that of a BFH bank.

The difference between these two 'types' of banks, then, can be summarised as follows. Private banks operating in the manner of the ducat-issuing bank maintain the exchange value of their currencies via adjustment of the interest rates at which they are prepared to lend these currencies, and must accept the market determined exchange rates of their currencies against the dollar that are consistent with this lending rate. Banks operating in the manner of the solid-issuing bank, however, maintain the exchange value of their currencies by standing ready to exchange them for sufficient dollars to buy some commodity bundle; that is, by 'pegging' the dollar exchange rate of their currencies at a level dictated by a BFH-like rule. Given this exchange rate, and the nominal interest rate set by the (ex) Central Bank, these banks are forced to set the nominal interest rates on their loans (and deposits) at levels consistent with interest parity if they wish to avoid either accumulating or losing dollar currency reserves.

In the discussion that follows we will assume, without loss of generality, that there are only three banks competing in the production of fiduciary currencies, namely the old Central Bank, which issues dollars, a ducat-issuer and a solid-issuer. Considering that the costs of computing conversion values, as well as the costs of detecting counterfeit notes, increase with the number of currency 'brands' in circulation, we would in any case not expect a proliferation of such brands.

Operationality

In the system described above, the existing medium of

exchange and unit of account is the dollar. The potential now exists for either the ducat or the solid (or both) to coexist with, or ultimately replace the dollar in both of these roles, and we examine each of these possibilities in turn.

As specified above, the ducat-issuer operates just like the dollar-issuing bank, and there is a flexible, market-determined exchange rate between these two currencies. Although these two banks are actively competing in this case, such a scenario reproduces (on a national scale) the institutional arrangements we currently observe between two Central Banks on an international scale. Only by successfully maintaining the stability and predictability of the purchasing power of their currencies, however, can these banks now increase the 'confidence' agents have in their currencies and thereby increase the acceptability and circulation of their currencies. The incentives (in the form of seigniorage rents) to maintain and increase the *circulation* of their currencies by 'successful' performance imply that a competitive currency regime where banks operate like ducat (or dollar) issuers would indeed be operational. This is not to say that every bank operating under this regime will act in the interest of its note and deposit holders: clearly some banks may renege on their contractual obligations and price-level policies in pursuit of short-term gains.

Turning now to the solid-issuing bank, recall that it resembles a BFH bank under our variant of the BFH system in section 2.4. above. Although the redemption medium in this case is dollar currency, section 2.4. shows that a system characterised by such banks could be operational. Our analysis in that section

indicates however that a solid-issuing bank could never, via competitive means, *displace* the dollar-issuing bank, since the rule whereby the solid-issuer maintains the purchasing power of its monetary unit *presupposes* that it can observe the *dollar* prices of the commodity bundle defining that unit. Hayek's (1978) contention, therefore, that his proposal entails "a displacement of the national circulations [ie. the dollar in this case] ... if the national monetary authorities misbehaved" (1978:21) is incorrect. No matter how badly the dollar-issuing bank 'misbehaves' (ie. depreciates its currency), the solid cannot displace the dollar from its role of unit of account if the solid-issuing bank is to maintain its convertibility rule (ie. maintain a determinate exchange rate between solids and dollars)⁴⁸. By adopting this convertibility rule the solid-issuing bank effectively constrains its ability to compete with other banks and would be unable, ultimately, to capture a significant proportion of the currency 'market'. Thus although a competitive fiduciary currency regime characterised by banks operating like the solid-issuing bank would be operational, we would not expect such a system to emerge upon deregulation of existing monetary systems.

Conclusion.

Klein (1974) has provided theoretical grounds for the result that a competitive fiduciary currency regime does not imply

⁴⁸Note that the solid-issuing bank would be forced to alter its operating procedure if the *ducat* displaced the dollar as the routinely used unit of account, and that this is likely to occur precisely when the dollar-issuing bank misbehaves.

infinite (or indeterminate) price levels. Hayek (1978, 1984) proposes such a regime on the grounds that fiduciary currency, which is accepted "only because people trust the issuer to keep it stable" (1978:107), is preferable over fiat currency, which "people have been forced to accept" (1978:107) and which has a history of "inflation engineered by government" (1978:29). Parts of Hayek's specification of such a system, however, were found to be implausible. This suggests that an operational regime of the kind proposed by Hayek would be characterised by distinguishable currencies:

- (i) exchanging at flexible, market determined exchange rates, and
- (ii) issued by banks who regulate the quantity of their notes and deposits in circulation by adjusting the nominal interest rates they charge for loans of their currency and offer on deposits of their currency.

Notice, however, that displacement of the existing national currency occurs only if the (ex) Central Bank does not maintain the stability and predictability of that currency's purchasing power. Agents will only be willing to accept a 'new' fiduciary currency if they have incentives to do so and, in the opinion of Klein (1976) and Friedman and Schwartz (1986), these incentives may have to be quite substantial (ie. a very unstable and unpredictable inflation rate in the national currency). Nonetheless, it remains true of the proposed regime that there are no longer any barriers to entry in the currency industry, and thus that agents are able to adopt alternative fiduciary currencies whenever they perceive the behaviour of the monetary authorities to be undesirable. The threat of competition, therefore, will act

to constrain and influence the decisions and behaviour of the monetary authorities in a more direct way than a monetary 'constitution'.

Ultimately, however, a preference for a competitive fiduciary currency regime over existing fiat regimes must derive from the (questionable) notion that one *cannot* ensure that the monetary authorities strictly pursue a stable price-level policy. To argue, as Hayek does, that his proposal will "eliminate all the causes of the alternation of inflationary booms and periods of depression which have plagued mankind ever since deliberate attempts at a central control of money have been made" (quoted in Fischer, 1986:434), is simply an unjustifiable conjecture.

We turn now a proposed payments system that is also characterised by competitive, unregulated financial intermediaries but, rather than issuing currency, these banks provide access to an accounting system of exchange.

4. Accounting Systems of Exchange

Introduction

This section examines the operationality of a payments system in which exchanges routinely occur via an accounting system of exchange provided by competitive, unregulated banks. Such a payments system, which was first forwarded by Black (1970), has subsequently been described in detail by Fama (1980, 1983) and has been incorporated as a feature of various recent proposals for monetary reform⁴⁹. Although there are unit of account prices in Black's (1970) proposed system, no medium of account is defined and there is no indication of how unit of account prices are determined. Fama (1980) specifies a real good (namely barrels of oil) as the medium of account and, as his specification incorporates the major features of Black (1970), we therefore examine the operationality of an accounting system as described by him. Note that Fama's objective is to illustrate the notion that financial intermediaries play no special role in the determination of the price level, and he pays no attention to the operationality of an accounting system. Fama seeks to show that, in principle, there can exist payments systems in which price level control is not dependent on the regulation of financial intermediaries.

As before, our method of analysis will be to examine whether the accounting system, as specified by Fama (1980), can be

⁴⁹See White (1984b) and Cowen and Kroszner (1987) for reviews of this literature. We are not aware that Fama intends his own analysis as a proposal for monetary reform.

sustained over time in an economy with market pricing. It is found that the medium of account must be tradeable *directly* (that is, outside the accounting system) against at least one asset in the asset market underlying the accounting system for such a system to be operational. If the medium of account is itself an accounting entry that functions as a medium of exchange, however, all payments can be made via an accounting system of exchange. Since such a medium of account could conceivably be provided by Central Banks in an unregulated payments system, we describe such a regime and find it to be operational. This substantiates Fama's result that unregulated payments systems may exist in which Central Banks nonetheless have control over the price level.

4.1. An Accounting System Without A Central Bank

Description

Let us assume, to begin with, a world in which financial intermediation is unregulated, and that neither a Central Bank nor any hand-to-hand medium of exchange has survived the transition to this world. Exchanges routinely occur via an accounting system of exchange provided by financial intermediaries. We assume further that the numeraire, or medium of account, is oil, and that all prices are quoted in terms of 'standard' barrels of oil.

According to Fischer (1982), "there is nothing in most monetary analyses that determines the choice of numeraire" (1982:8), and this is indeed true of Fama's analysis. As oil is neither a medium of exchange nor legal tender in his scenario, there are no compelling reasons why agents should quote prices in terms of oil rather than any other good in the economy. Contrary

to monetary history, then, which suggests that agents typically quoted prices in terms of the medium of exchange, choice of the numeraire in the accounting system envisaged by Fama is essentially arbitrary, and it is simply *assumed* that some good in the economy performs (and will continue to perform) this function. Fama's spaceship parable (1980:55-56), in which the government decides to replace the existing unit of account (steel ingots) with an abstract unit of account called the "Unit", is subject to a similar problem. As McCallum (1985) has pointed out, creating a demand for "Units" by regulation is not a *sufficient* condition to ensure that they become the economy's unit of account. There is no reason why steel (in Fama's parable) should not remain the medium of account.

According to Fama (1980), competitive 'banks' in this scenario provide two major services. Firstly, they *manage portfolios* for agents; that is, they take 'wealth' provided by 'depositors' and use it to purchase marketable securities and loans held on behalf of depositors. Secondly, they provide an *accounting system* for exchanging claims against wealth among depositors. For both of these services, banks charge competitive fees.

For purposes of definition, therefore, we may consider Fama's 'banks' to be checkable mutual funds and 'deposits' to be shares (or ownership units) in the underlying asset portfolios of these funds. Notice that banks do *not* stand ready to convert deposits into either currency or barrels of oil⁵⁰, and further that deposits

⁵⁰ 'Deposit' is thus a rather inappropriate term, since there is in

have a value (expressed in barrels of oil) which fluctuates as the market value of the portfolio of which they are a share fluctuates⁵¹. The solvency of these 'banks' (checkable mutual funds) is always assured since the value of their liabilities falls with the value of their assets. Financial intermediation in this payments system thus avoids the possibility of bank failures due to 'runs' on banks, a problem which has historically characterised the 'free' banking systems discussed in section 2.3. above and which persists under existing fiat standards (see King 1983 and Goodhart 1989).

Financial securities in this accounting system are not materially different to those in current asset markets. Common stocks (ordinary shares) denote ownership of firms, can pay dividends via the accounting system, and have a market determined price in terms of oil (see below). Bonds may be claims to deposits denominated in barrels of oil. As Keynes has noted, "it is of the essence of a debt to be enforceable in terms of something other than itself" (1930:6), thus we take it for granted that the 'circularity' problem pointed out by White (1984b, 1986) and Hoover (1988) does not arise in the accounting system described here.

Any transaction requiring a transfer of wealth between agents would occur via the accounting system provided by banks. A purchase of goods would be accomplished, in the normal way, by the

fact no element of convertibility involved. We use the term only because Fama uses it.

⁵¹The asset market is discussed more fully below.

buyer writing a check on his deposit⁵². The buyer's bank thus debits the buyer's deposit, while the seller's bank credits the seller's deposit, for the amount of the transaction. If both agents are with the same bank, this transaction would, according to our definitions above, simply amount to a transfer of ownership of a portion of its underlying asset portfolio from the buyer to the seller. If the agents are with different banks, the debit to the sending account generates a sale of securities from the portfolio of which the sending depositor has a share, while the credit to the receiving account generates a purchase of securities for the portfolio of which the receiving depositor has a share.

Finally, Fama remarks that "an accounting system for completing transactions does away with the need for a *physical* medium of exchange to settle transactions" (1983:10, emphasis added). While this is indeed the case, it should be clear that bank deposits, even though they are intangible accounting entries, are the medium of exchange since they are routinely accepted in exchange for goods and services. Although it is correct to consider an accounting system of exchange as a 'cashless' payments system, it is incorrect to infer from this that there is no medium of exchange or that an accounting system does away with the need for a medium of exchange altogether.

Operationality

The above description specifies an accounting system, as

⁵²Clearly one can envisage other means of accessing the accounting system, ie. via an electronic signal rather than a paper check.

envisaged by Fama (1980, 1983), whose unit of account is 'a barrel of oil', and whose medium of exchange is accounting entries denoting barrel-of-oil denominated bank deposits. This means that agents post prices for the goods they trade in terms of barrels of oil, since that is the denomination of the payment they routinely expect to receive. An agent's response to non-zero excess demand for his good is then an adjustment in the barrel of oil price of the good. There is, however, a difficulty with this response in the oil market itself.

Unlike all other agents in the economy, oil sellers cannot, via the accounting system, change the *barrel of oil* price of their output when facing (say) an excess demand for oil. It is clearly inconsistent for oil sellers to post a price of more than 'one barrel of oil' for a barrel of oil: this would mean that they were asking for more than 'one barrel of oil worth' of securities in exchange for a barrel of oil, and would imply that the unit of account no longer bore any specific, or operationally meaningful, relation to a barrel of oil. In short, the specification of the system above violates one of Patinkin's (1961) necessary conditions for rendering a monetary system determinate, since non-zero excess demands for oil (the medium of account) imply that it would *not* be sold "at face value stated in terms of the unit of account" (Fama, 1983:17). Considering that oil is the numeraire, excess demands for oil require, instead, that the oil price of the assets being traded for oil via the accounting system *fall*. There is, however, no way this can be brought about when oil sellers always sell their output via the accounting system of exchange.

In order to render this accounting system of exchange

operational, it is therefore necessary to introduce a market on which oil is traded directly against at least one other asset in the economy. This would give oil sellers recourse to the price system as a means of responding to an excess demand for oil, since they would now be able to demand more of the asset in exchange for oil, and thereby cause the barrel of oil price of that asset to fall. *Ceteris paribus* (that is, in the absence of changes in the value of other assets relative to that of the asset traded against oil), this would lead agents in the asset market to revise all other asset prices in terms of oil downwards. The lower 'oil value' of bank deposits (ie. units in an asset portfolio) would then imply a reduction in aggregate demand for goods and services as agents are less wealthy and, ultimately, a fall in the oil price of goods and services in general. The inclusion of an oil-for-asset market thus provides a means whereby the oil prices of assets and goods can adjust in the direction consistent with alleviating non-zero excess demands in the oil market⁵³.

Fama's asset market, then, in which assets are traded against each other, is a sufficient mechanism for establishing relative prices of these assets, but not for establishing *barrel-of-oil denominated* asset prices unless oil is part of this market. Given this linkage between the numeraire and the assets underlying the accounting system, exchange via this accounting system is then sufficient to determine the prices of all goods and services in

⁵³Note that *actual* trades of oil for assets are not necessary to establish a barrel-of-oil price for assets. The potential for such trades to occur is *sufficient* to establish market-clearing asset prices in terms of oil.

the economy in terms of this numeraire. The presence of a market in which oil is traded directly for some other asset is thus necessary and sufficient for operationality of an accounting system of exchange with oil serving as the numeraire⁵⁴.

As noted above, nothing in our specification of this accounting system actually determines that oil serves as the medium of account. It is possible, therefore, to envisage an accounting system of exchange in which the medium of account consists of the liabilities of the Central Bank (as under present monetary arrangements), and we specify such a system below.

4.2. An Accounting System With A Central Bank Specification

Assume now that we are in an unregulated financial system whose medium of account consists of the liabilities of the Central Bank (rather than oil), and that these take the form of *intangible* accounting entries⁵⁵ denominated in dollars (the unit of account). This scenario could conceivably arise if transactions technology were sufficiently advanced to allow these accounting liabilities to function as the medium of exchange, and may be thought of as a system in which currency is tendered and transferred exclusively

⁵⁴In terms of Fama's own analysis, this market satisfies his requirement that "to make a unit of account meaningful as the word used to state prices, it must be defined in terms of a real numeraire good that has *determinate* relative prices in terms of other goods" (1983:17; emphasis added).

⁵⁵As opposed to the medium of account under existing fiat standards, which comprises both *tangible* currency and bank reserves (which take the form of accounting entries).

via electronic means. Since agents routinely accept dollar-denominated accounting entries in exchange for goods, they quote prices and express contracts in terms of dollars. The Bank issues its (accounting) liabilities exactly as it would under present fiat standards, namely by standing ready to lend them at an announced nominal interest rate (which we call Bank rate). Since agents quote prices in terms of these dollar liabilities the Central Bank can, by changing Bank rate, influence the supply of its dollar liabilities and so too the dollar price level.

Since banks are unregulated, we will assume that they offer dollar-denominated 'deposits' (as defined above) which provide access to an accounting system of exchange as described above. Agents hold some of their wealth in the form of these 'deposits', which correspond to ownership units in the underlying asset portfolios of banks (ie. mutual funds), and which have a fluctuating market-determined dollar value. Agents may also hold some of their wealth in the form of 'cash balances', however, which we define here as positive holdings of Central Bank liabilities with a constant nominal dollar value. To make payments in this system, therefore, agents may tender either Central Bank liabilities or mutual fund units; that is, agents conclude transactions by electronic transfer of accounting entries which correspond either to 'cash balances' or 'deposits', as we have defined them.

Operationality

In the payments system specified here, dollar denominated accounting liabilities issued by the Central Bank serve as medium

of account and medium of exchange. Dollar-denominated accounting entries denoting 'deposits' provided by competitive unregulated 'banks' (checkable mutual funds), however, also serve as a medium of exchange. Agents post prices for the goods they trade in terms of dollars, since that is the denomination of the payment media they expect to receive. An agent's response to non-zero excess demand for his good is thus an adjustment in the dollar price of that good.

The assets underlying the accounting system provided by banks also have market-determined prices in terms of dollars, since agents can purchase these assets with the accounting liabilities of the Central Bank. Given these market-determined (dollar) asset prices, agents are indifferent between receiving a 'dollar worth' of cash balances or deposits in exchange for goods. A crucial condition underlying the operationality of this accounting system, therefore, is that a demand exists for Central Bank liabilities as a medium of exchange (or means of payment). If these liabilities were never traded for at least one of the assets underlying the accounting system, it would be impossible to determine the dollar prices of assets, and hence also the dollar prices of goods in general. Notice that this condition merely restates our earlier result that the medium of account must be tradeable directly against at least one of the assets underlying the accounting system for this system to be operational. The present system, however, has a medium of account which takes the form of an accounting entry, implying that all transactions are concluded via an accounting system of exchange.

The major difference between the present system and that

specified in 4.1. above is the presence of the Central Bank. By changing Bank rate the Central Bank can influence the supply of its dollar-denominated (accounting) liabilities, and thereby influence the dollar price level. As under present arrangements, a higher Bank rate (say) would be consistent with a reduction in the amount of Central Bank liabilities in circulation, resulting in a lower dollar price level.

Conclusion

Accounting systems of exchange as specified in this section are operational as long as the medium of account (or numeraire) is directly tradeable for at least one of the assets underlying the 'deposits' that constitute an accounting system. These trades (or potential trades) are necessary and sufficient to determine unit of account prices in such a system.

In existing monetary regimes the medium of account consists of liabilities (ie. currency and reserves) issued exclusively by the Central Bank. These liabilities also function as a medium of exchange. It is possible, therefore, to envisage a monetary system in which these liabilities take the form of intangible accounting entries, and payments are made via an accounting system of exchange. Such a system is operational as long as agents continue to demand Central Bank liabilities. This condition also implies, however, that the Central Bank has control over the price level (expressed in terms of these liabilities). Although banks are unregulated in this payments system, they take the form of checkable mutual funds, thus assuring their solvency. The distinguishing feature of such a payments system is that the

transfer of accounting entries is the exclusive means of concluding transactions.

Conclusion

All the proposed alternative monetary regimes considered by this paper either are operational or, by further assumption, can be made operational. According to our definition of operationality, this implies that the institutional rules which would constitute each proposed regime are sustainable over time in an economy with market pricing. On the other hand, there are several instances in which we find that the regimes do not have the properties claimed. The main results of our analysis, which have been listed in the introduction to this paper, are now summarised.

In Chapter 2 it is found that none of the alternative monetary regimes which are derivatives of a commodity standard, namely those proposed by Hall (1982), White (1984) and Greenfield and Yeager (1983, 1989), have the desirable properties claimed for them by their originators. Our analysis thus corroborates Fischer's (1986:21) view that "anything that commodity money schemes can accomplish can be done more cheaply in a related fiat money system". Further results are reached regarding Greenfield and Yeager's (1983, 1989) BFH system in particular, which encompasses Fisher's (1912) 'compensated' dollar, and is receiving some popular attention⁵⁶. In this system the purchasing power of a medium of exchange can purportedly be kept constant over time by

⁵⁶ *The Economist*, for example, concludes a recent feature on currency reform by noting that "if the world is one day going to have a common currency, this [referring to a BFH system] might be the safest way of ensuring that it is a non-inflationary one" (Jan 6, 1990:22)

making it convertible into a redemption medium (like gold, or an existing fiat currency) in sufficient amounts to buy some broadly defined consumption bundle. We show that this mechanism depends on observability of the prices of the goods comprising the consumption bundle in terms of the redemption medium. This implies that the redemption medium itself has to function as a medium of exchange (and medium of account). Establishing an 'inflation-proof' currency in the manner proposed by Greenfield and Yeager thus *presupposes* the continued usage of a currency which is not 'inflation-proof'. We also show the error in Greenfield and Yeager's claim that their BFH system 'separates' the unit of account from the medium of exchange and thus eliminates the possibility of 'monetary disequilibrium'. This claim is incorrect since the BFH system can only ever *coexist* with a monetary regime whose unit of account and medium of exchange are not separated.

In Chapter 3 we review the competitive fiduciary currency regime as proposed by Hayek (1978, 1984), which has the merit of offering agents choice over the monetary unit they adopt for expressing prices and contracts, and the currency they use for the purposes of transacting. We confirm that such a system has the potential for achieving stable price levels in terms of these competing monetary units in the absence of regulation and supervision by any public (political) agency such as a Central Bank. There remains, however, the possibility of disruption of the payments system by banking crises, thus justifying centralised regulation, despite Hayek's argument to the contrary.

In Chapter 4 the accounting system of exchange, proposed by

Black (1970) and described by Fama (1980), is found to be immune to banking 'panics' or crises. Banks in this system provide payments services by issuing deposits as they do today, but the nominal value of these liabilities fluctuates in line with the nominal value of their underlying portfolio of marketable assets. A fall in the value of these assets reduces the value of depositors 'units' and so too their incentive to withdraw these funds on a large scale thereby disrupting the payments system. Such a system thus removes any rationale for Central Bank regulation and supervision of the payments system. A role for the Central Bank may exist however in providing a medium of account (which functions also as the medium of ultimate settlement) comprised of its accounting liabilities. As long as a demand for these liabilities exists so as to define the unit of account, all transactions can occur via an accounting system of exchange. By applying monetary policy as under existing fiat standards, the Bank can also potentially achieve a stable price level expressed in the unit of account.

Amongst the alternative monetary regimes this paper has considered, possibly the most preferable would be one in which payments services are provided exclusively by the 'deposits' of competitive mutual funds as described by Fama (1980, 1983). This is the only operational system which, potentially, combines the two desirable properties: (i) given responsible Central Bank behaviour the price level can be stable and (ii) the system would not be susceptible to banking crises. Evidence suggests that financial intermediation under international deregulation is in any case evolving towards this system: banks actively provide

portfolio management services, whilst non-banks (ie. mutual funds) are increasingly offering access to payments services. Evolution towards such a monetary system would effectively undermine any rationale for Central Bank regulation and supervision since, taken to the limit, it would eliminate the possibility of banking crises. By contrast, a proposal such as Hayek's (1978), although it envisages an unregulated monetary system, nonetheless has features which justify such control and supervision. These originate in Hayek's acceptance that banks would not all issue their own currencies: many banks would in fact issue fixed (nominal) value deposits convertible on demand into another banks' currency and make loans denominated in that currency. The *informational asymmetries* that exist between depositors and these banks, coupled with the *fixed nominal value* of deposits and *nonmarketable* nature of bank assets, imply that these banks would always face positive default risks and the possibility of bank 'runs'. Thus while banking panics may now be unlikely to spread between the competing currencies, the functioning of the payments system may still be prone to disruption by runs on any particular currency. This provides the rationale for supervision⁵⁷ (by a Central Bank), although Hayek himself denies this possibility⁵⁸.

⁵⁷If we consider the efficient functioning of a payments system to be a public good.

⁵⁸Hayek (1978:61) contends rather that 'secondary' banks would have to practice "something very close to 100% banking". 100% banking removes their profitability along with their risk. Alternatively, 100% deposit insurance merely shifts the risk onto the insurers, while increasing the moral hazard problem associated with insurance.

The problem with Hayek's proposal, as with existing banking systems, is really that "the nature of bank portfolios, largely filled with non-marketable assets of uncertain true value held on the basis of nominally fixed liabilities ... seem remarkably unsuited to form the basis of our payments system" (Goodhart, 1989:93). A monetary system in which transactions (or payments) services were provided rather to unit holders of collective investment mutual funds, because it promises immunity to banking crises, is inherently safer than either our present system or Hayek's proposed alternative. If the current round of international deregulation can move banking systems in this direction, there should be little need for design of new monetary arrangements.

Bibliography

- Barro, R.J. (1979) "Money and the Price Level Under the Gold Standard" *Economic Journal*, 89, pp.13-34.
- Beale, W.T.M., Kennedy, M.T. and Winn, W.J. (1942) "Commodity Reserve Currency: A Critique" *Journal of Political Economy*, 50, August, pp.578-594.
- Black, F. (1970) "Banking and Interest Rates in a World Without Money: The Effects of Uncontrolled Banking", *Journal of Bank Research* (Autumn), pp.9-20.
- Black, F. (1987) "A Gold Standard with Double Feedback and Near Zero Reserves" in Black, F. *Business Cycles and Equilibrium* (New York: Basil Blackwell), pp.115-120.
- Bordo, M.D. (1984) "The Gold Standard: The Traditional Approach" in Bordo, M.D. and Schwartz, A.J. (eds) *A Retrospective on the Classical Gold Standard, 1821-1931* (Chicago: University of Chicago Press), pp.23-120.
- Bordo, M.D. and Schwartz, A.J., eds (1986) *A Retrospective on the Classical Gold Standard, 1821-1931* (Chicago: Chicago University Press)
- Bryant, J. (1989) "Interest-Bearing Currency, Legal Restrictions, and the Rate of Return Dominance of Money" *Journal of Money, Credit and Banking*, 21, 2, pp.240-245.
- Campbell, C.D. and Dougan, W.R. (1986) "Introduction" in Campbell, C.D. and Dougan, W.R. (eds) *Alternative Monetary Regimes* (Baltimore: Johns Hopkins), pp.1-15.
- Cooper, R.N. (1982) "The Gold Standard: Historical Facts and Future Prospects" *Brookings Papers on Economic Activity*, 1, pp.1-45.
- Cooper, R.N. (1988) "Toward an International Commodity Standard?" *Cato Journal*, 8, 2, pp.315-338.

- Cowen, T. and Crossner, R. (1987) "The Development of the New Monetary Economics" *Journal of Political Economy*, 95, 31, pp.567-590.
- Cowen, T. and Crossner, R. (1989) "Scottish Banking Before 1845: A Model for Laissez-Faire?" *Journal of Money, Credit and Banking*, 21, 2, pp.221-231.
- Dowd, K. (1988) *Private Money: The Path to Monetary Stability*, Hobart Paper 112 (London:Institute of Economic Affairs).
- Dowd, K. (1988a) "Automatic Stabilising Mechanisms Under Free Banking" *Cato Journal*, 7, 3, pp.643-659.
- Fama, E.F. (1980) "Banking in the Theory of Finance" *Journal of Monetary Economics* 6, pp.39-57.
- Fama, E.F. (1983) "Financial Intermediation and Price Level Control" *Journal of Monetary Economics*, 12, pp.7-28.
- Fisher, I. (1912) *The Purchasing Power of Money* (New York:MacMillan).
- Fischer, S. (1983) "A Framework for Monetary and Banking Analysis" *Economic Journal*, 93, pp.1-16.
- Fischer, S. (1986) "Friedman Versus Hayek on Private Money" *Journal of Monetary Economics*, 17, pp.433-439.
- Fischer, S. (1986a) "Monetary Rules and Commodity Money Schemes Under Uncertainty" *Journal of Monetary Economics*, 17, pp.21-35.
- Friedman, M. (1951) "Commodity-Reserve Currency" *Journal of Political Economy*, 59, pp.203-232.
- Friedman, M. (1959) *A Program For Monetary Stability* (New York:Fordham University Press)
- Friedman, M. and Schwartz, A.J. (1986) "Has Government Any Role in Money?" *Journal of Monetary Economics*, 17, pp.37-62.

- Goodhart, C. (1983) *Money, Information and Uncertainty* (Cambridge:Cambridge University Press), pp.1-18.
- Goodhart, C. (1989) *The Evolution of Central Banks* (Cambridge, Massachussets:MIT Press), pp.13-28.
- Gorton, G. (1985) "Banking Theory and Free Banking History" *Journal of Monetary Economics*, 16, pp.267-276.
- Gorton, G. and Mullineaux, D.J. (1987) "The Joint Production of Confidence: Endogenous Regulation and Nineteenth Century Commercial-Bank Clearinghouses" *Journal of Money, Credit and Banking*, 19, 4, pp.457-468.
- Greenfield, R.L. and Yeager, L.B. (1983) "A Laissez-Faire Approach to Monetary Stability" *Journal of Money, Credit and Banking*, 15, 3, pp.302-315.
- Greenfield, R.L. and Yeager, L.B. (1989) "Can Monetary Disequilibrium Be Eliminated?" *Cato Journal* (forthcoming).
- Hall, R.E. (1982) "Explorations in the Gold Standard and Related Policies for Stabilising the Dollar" in Hall, R.E. (ed) *Inflation* (Chicago:University of Chicago Press), pp.111-122.
- Hall, R.E. (1982a) "*Monetary Trends in the United States and the United Kingdom: A Review from the Perspective of New Developments in Monetary Economics*, *Journal of Economic Literature*, 20, pp.1552-1556.
- Hall, R.E. (1984) "A Free Market Policy to Stabilise the Purchasing Power of the Dollar" in Siegel, B.N. (ed) *Money in Crisis* (Cambridge, Massachussets:Ballinger), pp.303-321.
- Hayek, F.A. (1976) *Denationalisation of Money, Hobart Paper 70* (London:Institute of Economic Affairs).
- Hayek, F.A. (1984) "The Future Monetary Unit of Value" in Siegel, B.N. (ed) *Money in Crisis* (Cambridge, Massachussets:Ballinger), pp.323-325.

- Hoover, K.D. (1988) "Money, Prices and Finance in the New Monetary Economics" *Oxford Economic Papers*, 40, pp.150-167.
- Keynes, J.M. (1930) *A Treatise of Money: The Pure Theory of Money* (London:MacMillan).
- Keynes, J.M. (1931) *A Treatise on Money: The Applied Theory of Money* (London:MacMillan).
- King, R.G. (1983) "The Economics of Private Money" *Journal of Monetary Economics*, 12, pp.127-158.
- Klein, B. (1974) "The Competitive Supply of Money" *Journal of Money, Credit and Banking*, November, pp.421-453.
- McCallum, B.T. (1983) "The Role of Overlapping Generations Models in Monetary Economics" in Brunner, K. and Meltzer, A. (eds) *Carnegie-Rochester Conference Series on Public Policy*, pp.129-164.
- McCallum, B.T. (1985) "Bank Deregulation, Accounting Systems of Exchange, and the Unit of Account: A Critical Review" *NBER Working Paper Series: Working Paper No.1572*, March.
- McCallum, B.T. (1989) *Monetary Economics*, (New York:MacMillan).
- Meltzer, A.H. (1986) "Some Evidence on the Comparative Uncertainty Experienced Under Different Monetary Regimes" in Campbell, C.D. and Dougan, W.R. (eds) *Alternative Monetary Regimes* (Baltimore:Johns Hopkins), pp.122-153.
- Moore, B.J. (1988) *Horizontalists and Verticalists: The Macroeconomics of Credit Money* (Cambridge:Cambridge University Press).
- Mullineaux, D.J. (1987) "Competitive Monies and the Suffolk Bank System: A Contractual Perspective" *Southern Economic Journal*, April, pp.884-898.

- O'Driscoll, G.P. (1986) "Deregulation and Monetary Reform" *Federal Reserve Bank of Dallas Economic Review*, July, pp.19-31.
- Osborne, D.K. (1984) "Ten Approaches to the Definition of Money" *Federal Reserve Bank of Dallas Economic Review*, March, pp.1-23.
- Patinkin, D. (1961) "Financial Intermediation and the Logical Structure of Monetary Theory" *American Economic Review*, 51, March, pp.95-116
- Rolnick, A.J. and Weber, W.E. (1988) "Explaining the Demand for Free Bank Notes" *Journal of Monetary Economics*, 21, 1, pp.47-71.
- Schwartz, A.J. (1986) "Alternative Monetary Regimes: The Gold Standard" in Campbell, C.D. and Dougan, W.R. (eds) *Alternative Monetary Regimes* (Baltimore:Johns Hopkins), pp.44-72
- Selgin, G.A. and White, L.H. (1987) "The Evolution of a Free Banking System" *Economic Inquiry*, July, pp.439-457.
- Selgin, G.A. (1988) "Accommodating Changes in the Relative Demand for Currency; Free Banking vs Central Banking" *Cato Journal*, 7, 3, pp.621-641.
- Thompson, E.A. (1974) "The Theory of Money and Income Consistent With Orthodox Value Theory" in Horwich, G. and Samuelson, P.A. (eds) *Trade, Stability and Macroeconomics* (New York:Academic Press), pp.427-453.
- Timberlake, R.H. (1984) "The Central Banking Role of Clearinghouse Associations" *Journal of Money, Credit and Banking*, 16, 1, pp1-15.
- Vaubel, R. (1984) "The Government's Money Monopoly: Externalities or Natural Monopoly?" *Kyklos*, 37, 1, pp. 27-58.

- Wallace, N. (1988) "A Suggestion for Oversimplifying the Theory of Money" *Economic Journal*, 98, Conference, pp.25-36.
- White, L.H. (1983) "Competitive Money, Inside and Out" *Cato Journal*, 3, 1, pp.281-299.
- White, L.H. (1984) "Free Banking as an Alternative Monetary System" in Siegel, B.N. (ed) *Money in Crisis* (Cambridge, Massachussets:Ballinger), pp.269-301.
- White, L.H. (1984a) *Free Banking in Britain: Theory, Experience and Debate 1800-1845* (Cambridge:Cambridge University Press).
- White, L.H. (1984b) "Competitive Payments Systems and the Unit of Account" *American Economic Review*, 74, 4, pp.699-712.
- White, L.H. (1986) "Competitive Payments Systems: Reply" *American Economic Review*, 76, 4, pp.850-853.
- White, L. H. (1987) "Accounting for Non-Interest Bearing Currency: A Critique of the Legal Restrictions Theory of Money" *Journal of Money, Credit and Banking*, 19, 4, pp.448-456.
- Whittaker, J. and Theunissen, A.J. (1987) "Why Does the Central Bank Set the Interest Rate?" *South African Journal of Economics*, 55, 1, pp.16-33.
- Yeager, L.B. (1983) "Stable Money and Free-Market Currencies" *Cato Journal*, 3, 1, pp.305-333.
- Yeager, L.B. (1985) "Deregulation and Monetary Reform" *American Economic Review*, 75, 2, pp.103-107.
- Yeager, L.B. (1989) "A Competitive Payments System; Some Objections Considered" *Journal of Post Keynesian Economics*, 11, 3, pp.370-377.