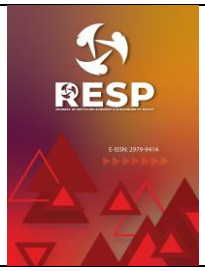
JOURNAL OF RECYCLING ECONOMY & SUSTAINABILITY POLICY 20232(2) 16-23



RESP

e-ISSN: 2979-9414

AraştırmaMakalesi ● Research Article

On Digital Money

Dijital Para Üzerine

Romar Correa [a, *]

[a]Prof.Dr., Reserve Bank of India; Mumbai School of Economics and Public Policy, University of Mumbai, 400098, Mumbai / India.
ORCID: 0000-0002-4151-0301

ANAHTAR KELİMELER

Para döngüsü
Bir para ücretli emek standardı
Güvenlik duvarları

ÖZ

Dünya çapındaki yatay çıktı ve istihdam trendleri ve özel ve kamusal alandaki sanal para birimlerine odaklanan hareketli tartışmalar bağımsız konulardır. Bu çalışmada, bu iki unsuru birbirine bağlamaya çalışıyoruz. Parasal döngü süreci modeli, bir Merkez bankasının üretime yatırım yapmak için bir ücret faturası avansı şeklinde bir hesap oluşturarak faaliyet başlatması durumunda kullanılmaktadır. Bundan sonraki süreçler döngü sürecinin baskısıyla ayrı hesaplara kaydedilmelidir. Kapitalistler ve işçiler zamana göre risk-getiri ödemelerini optimize etmek için finansal piyasaları kullanmakta özgürken, biz kapitalistlerin ve işçilerin para ihtiyaçlarını yönetmek için dar bir merkez bankası hesabını, yöneticilerin ve rantiyelerin özsermaye hedeflerini izlemek için bir merkez bankası yatırım bankası hesabı öneriyoruz. Spesifik olarak, S.C. Goueviavd. (2017) dört senaryosunu kendi vakamızı geliştirmek için modifiye ediyoruz.

KEYWORDS

The monetary circuit
A money wage-labour standard
Firewalls

ABSTRACT

The flat output and employment trajectories worldwide and the animated discussion surrounding virtual currencies, private and public, are independent topics. We attempt to connect the two elements. The circuit model of the monetary process is used to make the case for a central bank initiating activity by creating an account in the form of an advance of a wage bill to invest in production. Processes thereafter must be recorded in separate accounts as the circuitistes insist. We make the case for a narrow bank account of the central bank managing the money needs of capitalists and workers, of the investment bank account of the central bank monitoring the equity objectives of executives and rentiers, while capitalists and workers are free to use financial markets to optimize their risk-return payoffs over time. Specifically, we modify the four scenarios of S.C. Gouevia et al. (2017) to develop our case.

1. Introduction

The empirical fact continues to be the numbness of economic activity of a scale and colour (green) fit to generate employment for millions of people in non-environmentally-debilitating jobs across the developed and developing world. The traditional response would be massive government expenditures across the gamut of physical and social infrastructure. However, since the other side of the State balance sheet, steeply progressive income and wealth taxation in a society polarised along those dimensions, has been universally abandoned by the economic policy establishment, the old policy intrusion does not pass academic muster. Ricardian equivalence, despite lack of unequivocal support, continues to rumble under the surface of academic discussion. Any goodies enjoyed by present generations will have to be paid for by generations to come goes the refrain. The sword of Damocles has always hung over quantitative easing programmes in the US and Europe and elsewhere at sessions of parliaments as politicians across the board fret about budget balance. We need to be reminded that all the propositions above, implicit and explicit, are theorems proved from the set of assumptions of a specific model. Other models exist.

We offer the circuit approach to monetary macroeconomics as an original approach to the theme that joins the monetary and the real in a novel theoretical structure. Starting from a clean slate, a sophisticated structure is built up from the creation of bank money. It turns out that the Schumpeter

* *Sorumlu yazar/Corresponding author*.
e-posta: : *romarcorrea10@gmail.com*
*Atıf/Cite as:*Correa, R.(2023). On Digital Money.*Journal of Recycling Economy & Sustainability Policy*,2(2), 16-23.
Received Feb 2, 2023; Received in revised form 5 Feb 2023; Accepted Aug 4, 2023

This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors.

proposition "loans create deposits" and therefore money has been supported by scholarship at the Bank of England, the IMF, and other mainstream schools. Since the structure is purely analytical, the motive force driving bank and entrepreneur and workers together is not addressed. Given the endurance of the current milieu we will make the case in logic and history that it is natural to append central to the bank Coming to the present and the theme of the paper, Dirk Niepelt (2018) has offered a neutrality theorem, that the substitution of central bank "reserves for money" for inside money is painless. The view that disaggregated information at the hands of private banks and their clients cannot be aggregated to statistics to be conveyed to central banks can also be countered. Records can be stored in decentralised private-banking systems and centralised central-banking systems as well. What about the Hayekian notion that knowledge of the "particularities of time and place" are the privilege of local borrowers and lenders. Here again, there is no reason to dispute the other Hayekian notion that in markets prices convey the same information to central bankers as they do to private bankers.

In what follows, we extend the connection with nonmainstream macroeconomics by providing our own balance-sheet segregations across financial entities. The next section begins with the kickstarting of the 'first moment' of circuit theory which is the birth of bank money in the form of a loan for productive purposes. The loan is the outlay on wages to workers. The following subsection is the 'second moment', the playing out of actions thereafter as firms and workers consume and save, the former also paying back the interest and eventually the principal on the loan. Secondly, we record the decisions of firms to issue shares to workers to fund fresh capital investment. Finally, the risk attributes associated with a machine delivering a stream of services over time can be minimized by recourse to derivatives and more elaborate devices offered by financial intermediaries. The 'third moment' is the closing of the accounts or terminal value conditions as debts are repaid and individuals conclude their lifetime plans.

2. The monetary circuit in a digital age

2.1. The 'first moment'

We whet the appetite for a modern treatment of the subject by providing a nonstandard treatment of standard Macro 101. The source is Godley & Cripps (1983), one of the most elegant books on macroeconomics of all time in its care for measurement issues and its defining characteristic of macroeconomic theory as a subject in its own right distinct from microeconomics. The connection with national income aggregates is intimate but the sub aggregates are rearranged to reflect the problems on hand. Thus, consider one such familiar arrangement respecting the axioms of arithmetic according to which total national income Y equals total national expenditure E.

$$E \equiv Y \tag{1}$$

Sub aggregating, there will be those whose income is in excess of expenditure and who, therefore, will be accumulating financial assets. As an initial institutional condition, we must assume that the only avenue available is a deposit in a bank, ΔFA. However, by the discipline imposed by equation 1, if some citizens are accumulating assets it must be the case that other citizens are accumulating debts, ΔD. In brief,

$$FA \equiv D. \tag{2}$$

We disentangle final expenditures into actual sales FE (C for the private sector of an economy and $C + G$ in an economy with government.) and inventory activity ΔI, goods in transit between storage bins and retail stores. Delta can be positive or negative reflecting inventory accumulation or drawdown. Also, working capital expenditures need to be incurred before final sales. We have

$$Y \equiv E \equiv FE + \Delta I. \tag{3}$$

Coming in from a different end, denoting total profits by Π and the wage bill, the product of the average wage and the number of people employed by WB,

$$\Pi \equiv FE - WB + \Delta I. \tag{4}$$

Combining equations 3 and 4, we have the known

$$Y \equiv \Pi + WB. \tag{5}$$

The most natural introduction to banks takes place at this juncture. Firms will perforce have credit lines open with their local or community banks so as to support inventory holdings. Coming to working capital requirements, Arthur Okun, one of the venerable sages of the macroeconomics of yesteryear, was especially eloquent on firms not terminating contracts during a downturn, seeking to retain the capital embodied in employees so as torealise the returns on their indivisible and dedicated skill sets once the upturn sets in in a few years. Old hands will stay on, metaphorically washing windows to finessing office records to monitoring stock movements in warehouses, at token stipends. Note that I, the more familiar symbol for investment, has not appeared because the context is one of extreme pessimism and the positive numbers backing projections like MEC schedules are not to be found. Production and ancillary activities are distinguished from the accumulation of capital. Denoting bank loans by LI, we have $\Delta LI \equiv \Delta I$. Or,

$$LI \equiv I \tag{6}$$

With $LI \equiv FA$, the circuit is complete. The direction of the causal arrows is paramount. In the rare event of income equalling expenditures and equation 2 becoming redundant, equation 6 would define a deposit for accounting purposes. In addition, modern extensions of stock-flow-consistent models have embraced the ecological dimensions of balance-sheet accounting (Dafermos, Nikolaidi and Galanis, 2017). Thus, the production process is defined to include the extraction of materials from the ground as well as, in our case, the recycling of produced economic stocks.

Coming to modern times, it is sufficient but not necessary to begin to make our case using the panoply of elements surrounding electronic money. One objective is to situate our discussion within society and outside bits and pulses between banks. Thus, bitcoin and other devices are founded on the idea of money as a 'thing'. It must be separate from the life of the community in general and the machinations of banks in particular (Dodd, 2017). It turns out, though, that the currency depends on a complex division of labourin order to be produced and disparities in wealth and power not different from the visible strata of finance capital are reproduced within. In addition, its adoption is seen as akin to a return to the gold standard (Heller, 2017). There is no mechanism to dampen price volatility on the occasions of sharp demand spikes and supply falls. Central banks will always dominate with their superiority in stabilising economies overall. Money must serve as a unit of account, a numéraire, in which prices and wage contracts are measured. All virtual currencies fail to meet the measure of money laid down by Stanley Jevons (Dabrowski and Janikowski, 2018). Wages are not paid in virtual currencies nor does any government accept them as legal tender. Money is bank money and that proposition leads immediately to problems of information asymmetry and adverse selection. The problem is best addressed by the institution of sovereign money. Indeed, free banking is likely to lead to credit rationing. High-risk borrowers will be screened in and blue-eyes borrowers fail to secure credit. Bitcoin fails this desideratum. At the same time, it is allegedly responsible for pioneering the use of distributed ledger (DL) technology which allows transfers of money at negligible cost.

Many central banks are looking to the technology of DLs to support central bank digital currencies (CBDCs) to widen their policy space albeit under potentially radical subversion of the assumptions underlying central bank and commercial bank monies. There is some pro and con but net a consensus seems to be emerging supporting central bank issuance of digital money (Fung and Halaburda, 2016; Engert and Fung, 2017). The possible scenarios are still being written and we add our model to the literature engaging both axioms and theorems (Gouveia et al, 2017). For instance, a 'digital fiat currency' (DFC) has been proposed which will be determined endogenously by banks not by the central bank thereby retaining the social welfare-enhancing practice of localised lending (Dow, 2018). Not dissimilarly, an 'account-based CBDC' has been worked out wherein accounts would be held directly at the central bank and access would be made available through public-private partnerships (Bordo& Levin, 2017). During a recession, the CBDC would operate the money-financed fiscal deficit that would follow. The stimulus funds would be deposited directly into the accounts of low-income households. It was Friedman who voiced the coordination of monetary and fiscal policy under such extenuating circumstances. The payments system operated in DFC controlled by the state would be separated from the ordinary business of banking. Banks would lend with due diligence but borrow DFC with the loans as collateral so that the supply of money would grow coterminously with the supply of credit. Indeed, we modify the conventional monetary economics foundations of the survey of Gouveia et al along accounting tracks to propose a coherent alternative which is a combination of their four scenarios proposed. Thus, we reconstruct option A root and branch as the first step of circuit theory in which blockchain technology is used for wage payment systems. Here, the CBDC would be held by central banks or nationalized banks mediating with employers and employees. Our simple reason is that that nowhere in these scenarios is any room left for banks underwriting projects and supporting employment.

Elaborating on Option A, the CBDC is restricted to employers accepting the government portmanteau of projects and workers employed on the projects. Ecological stock-flow-consistent economics referred to can be deployed to specify a green corporate bonds purchase by commercial/central banks in a global green quantitative easing (QE) programme. Dafermos et al calibrated a model with central banks all over the world and found salutary effects in 2020 in the scenario of a global commitment to the purchase of an unchanging share of 25% of outstanding green bonds. The set of banks would need to be extended to include small and local banks which would now possess a central bank settlement account. On this front, Farley Grubb has been waging a heroic battle against the quantity theory of money approach to modelling money in favour of the evidence that money originated as a zero-coupon bond (Cutsail& Grubb, 2017). The case in point was the emission by the British North American colonies of large amounts of paper money called bills of credit. Details about North Carolina's paper money emissions have been collected so as to determine the market value of the paper over its entire history. North Carolina's bills were structured as zero-coupon bonds which had legally-mandated maturities when they were paid off or paid in face value in specie to the government. They could be redeemed at face value any time after emission in payments of taxes. The paper money was not unlike a bearer bond that required an explicit redemption exercise to extinguish the principal on the face of the bill, information that was common knowledge. The Grubb present value formulation, a theme which will revisited below, is as follows with r the riskless discount rate, APV standing for expected real-asset present value, RED_t the face value of the quantity of North Carolina bills retired in year t, $M_j$the face value of the amount of North Carolina paper money outstanding in year j,

$$APV_j = \sum_{t=j}^{N} e^{-rt} \left(\frac{RED_t}{M_j} \right) \tag{7}$$

and

$$\sum_{t=j}^{N} \left(\frac{RED_t}{M_j} \right) = 1 \tag{8}$$

In short, the bonds were real barter assets. They has a

miniscule "moneyness' quality to them. Citizens paid a small premium above the *APV* to acquire bills because they were a more convenient medium of exchange in comparison with the next-best barter alternative.

The CBDC would not be anonymous. The nodes of the DL system and their wallets would be common knowledge. Our option A moves in the direction opposite to that of option A of the article in that it *brings to identity* the credit and payments aspects of the financial system. Option A is designed to write up the latter in terms of goods and services in the interest of earning profits in the real circuit. Sharing DLs with other countries allows the home central bank real-time information about foreign direct investment meeting the open-economy criteria of the monetary circuit. Dynamic monitoring of home-grown and as well as imported employment-generating activities aborts systemic crises on this account.

Connecting with Option C, CBDC as a new policy tool, the CBDC would be a *wage-backed currency*. Our option upturns the criticism of option C that the 'unit of account' property of money is brought into question under the scheme. In our interpretation, central bank money is a numéraire precisely because it underpins the wage rate.

In sum, the wage bill supporting the 'first moment' is $w_tN_t$where *t*is the present point in time, w_t a 'dignified wage' wage promulgated by the authorities say by ILO standards in the same period, and $N_t$is the number of workers able and willing to offer their services for 'decent work'. In that case, the liability side of the CBDC is given and the 'second moment' consists of workers spending their incomes and sales having beingrealised, capitalists consuming/saving theirs. At the same time, the bank must recover over time, albeit with hiccups, the initial wage bill disbursed as a loan to support the 'variable cost' posed by w_tN_t. The equation connecting it all, mainstream and non mainstream is the definition of profits:

$$\Pi = PS - w_tN_t - rL \tag{9}$$

The unsubscripted elements in the equations denote their realisation in the future, in the analytics of the second moment. Sales *S* would include sales to government, the *G* in a model which included the fiscal authority but here only consists of *C*, private consumption with the consumer price level *P*. Consumption, by definition, is consumption of both capitalists and workers over time. Likewise, while a loan, *L*, to defray the wage bill is taken out today, *t*, the repayment of interest, *r*, and principal, subscripted appropriately, will take place from *t*+1 onwards. The interest rate may be time-varying and the asset may turn out to be 'non-performing' taking a positive value in equation 7 mirrored in a negative value on the asset side of the bank balance sheet. We are in a position to distinguish between money as a productive asset and cryptocurrency as a speculative asset whose value exists in capital gains only (Claeys et al, 2018). In models of the latter, the characterisation of lending, as we see, does not appear. Either individuals would have to screen and audit projects themselves or the entities that emerge to monitor loans would be investment funds and not banks as their liabilities in cryptocurrencies would be equity not deposits.

2.2 The "second moment"

We assume that all classes will want a portion of their incomes failure- or risk-free.

Since consumption and savings and repayment of loans taken in the present can be realised over an infinite horizon as per life cycle considerations, we rewrite equation 9 separating out our anchor in the present in the form of the wage bill.

$$w_tN_t = \sum_{i=t}^{\infty} P_iC_i - \sum_{i=t}^{\infty} \Pi_t - \sum_{i=t}^{\infty} r_tL_t \tag{10}$$

The first term on the right-hand side can be divided into the consumption of Basics and the consumption of Luxuries. The subscripts *B* and *L* will distinguish the categories. Great store should not be laid on the categorisation. The rich menu of financial assets are options available to both capitalists and workers. We need to distinguish between the primary share issue of firms and workers obliging by purchasing these shares and both responding enthusiastically to constant innovations in financial markets. Superscripting the narrow bank account in the central bank as *NB*, the investment bank account in the central bank as *IB* and the cornucopia of items available in financial markets as *FM* and separating them on accounting principles, we arrive at

$$[(w_tN_t - \sum_{i=t}^{\infty} P_iC_{Bi}^{NB}) + \sum_{i=t}^{\infty}(\Pi_i - P_iC_{Li}^{NB})] = [(-w_tN_t + \sum_{i=t}^{\infty}(P_iC_{Bi}^{IB})) + (-w_tN_t + \sum_{i=t}^{\infty}(P_iC_{Bi}^{FM}))] + [\sum_{i=t}^{\infty}(-\Pi_i + P_iC_{Li}^{IB}) + \sum_{i=t}^{\infty}(-\Pi_i + P_iC_{Li}^{FM})] - \sum_{i=t}^{\infty} r_tL_t \tag{11}$$

The left-hand side is the liability side in our narrow bank account and the extreme right-hand side term on the other side is the asset term in the account. In the standard accounting framework of 100 percent reserve banking, the asset like the liability is near-money, an asset that can be liquidated at short notice without cost. While the latter is usually taken to mean government paper of short duration epitomising perfect liquidity, since the institution is the central bank of the country in the discussion below we suggest that government bonds backing real assets could provide an equivalent run-free portfolio. Even on their own terms, the selected projects will be at one end of the low-risk-high-return spectrum so the umbrella bank under which they are sheltered is a relatively failsafe organisation. In our categorisation, the option of relevance is D in which the CBDC is "non-anonymous and universal". The CBDC here is the same as making a deposit with a central bank. We note that by the criteria of the authors, option A is the least disruptive and option D the most disruptive. Betwixt is option C where the distinction between monetary and fiscal policy drops, the central bank balance sheet is all of a piece with the balance sheet of the treasury.

In nonmainstream economics, 'bringing the future to the

present' has come to occupy pride of place in calculations. Post Keynesians are ambitious of present value calculations for synthesising State and Credit Theories of Money. Compare, for instance, our equation 7 with the well-known nominal value of any asset (Tymoigne, 2017).

$$P_t = \sum_{n=1}^{N} \frac{E_t(Y_n)}{(1+d_t)^n} + \frac{E_t(FV_N)}{(1+d_t)^N}$$

The first term above denotes the stream of expected returns that might ensure over a horizon *N* where *N* could be infinity as in the case of a perpetuity. The second term is the face value of the bond at the terminal date, all values being capitalized by d_t, the current discount rate. In principle, the two expressions compare and the connection with a consol will become clearer in the next section. Even more ambitiously, an elaborate theory of value based solely on the calculus of discounting is the capital-as-power theory of value (Bichler and Nitzan, 2016; Cochrane, 2016). Different valuations by market participants are made commensurate by capitalization. The quantitative translation is carried on all the time. Both government expenditure and private consumption can be identically treated. The mysteries of the unfolding future can be reduced to a single number. In a nutshell, capitalization is the primary formality of capitalism.

A tributary flowing in the 'second moment' is firms financing capital acquisitions through the sale of shares. The other option to that end is retained earnings which used to be the main mode of financing in parts of the world. That fund for realising real investment plans has emptied under the sway of shareholder value maximization. In addition, the firm can approach the bank for a requited loan for the purpose but note that the sum disbursed would not be money originating in the 'first moment'. Workers can only buy shares from incomes earned therein and by our typology this purchase-sale is a financial transaction. So as not to mix categories and to separate out influences using the device of balance sheets we confine ourselves to the period after the 'first moment' and consider shares sold by firms to workers first. The income of the latter now includes a rentier portion which is the product of price r_E and quantity $E_F$where the latter stands for the quantity of equity issued by the firm. Ignoring the terms summing to an infinite horizon we have the following decomposition of the terms superscripted by *IB* on the right-hand side of equation 9. Recall that the term is the one part of the residual from wages and profits after the preferences for 'risk-free' assets are realised on the left-hand side of the equation. The balance sheet of the 'investment bank' sub matrix section of the central bank balance sheet would appear as follows.

Asset	Liability
$(w_t N_t + r_{Et+1}E_{Ft+1})$	$(\Pi_{t+1} - r_{Et+1}E_{Ft+1})$

The rentier income of the worker is matched by the liability of the firm and, consequently, the transaction is 'on balance sheet'. The 'investment bank' division of the central bank would track the 'second moment' of the originating 'first moment' of the project. While the accounts are aggregative, in the case of a particular firm the arithmetic is consistent with the institution of profit sharing or even quasi worker-controlled managements.

The argument for separating out the two sides of the balance sheets of the traditional bank was to protect deposits from the vagaries of returns on capital. So-called investment banks would have to issue equity to underwrite their projects and accordingly, the argument went, would be duly diligent in the selection of companies whose shares were on offer. In addition, workers might be unwilling or unable to fund the projects pushing firms to markets. Furthermore, given the sometimes unquantifiable uncertainties associated with the purchase of large capital equipment, firms will be inclined to turn to the market for futures and options designed precisely to price and buy/sell products to ameliorate these risks. The route taken by these instruments might take on complicated trajectories as they are mixed and matched across risk categories and hyperactively traded. However, the essential point must not be forgotten that in the end their market value must correspond with the present value of the stream of returns realised on the factory or the set of machines. We define the price and quantity of financial market equity backing firm equity by r_{FM} and E_{FM} respectively. In that case, we have the following balance sheet of a financial intermediary.

Asset	Liability
$r_{Et+1}E_{Ft+1}$	$r_{FMt+1}E_{FMt+1}$

Both items can be extended into liability-asset chains as the pulls and pushes of competition put pressures on margins. Indeed, the chains can interlock with the 'firm' being effectively a financial institution issuing debt to avail of the dominating returns offered in the financial circulation. We are 'off balance sheet' (of the central bank) or into the realm of 'shadow banking' or 'shadow finance'. The institutional contrast with the earlier balance sheet is complete. The present account is an offshoot of shareholder value maximization on the part of management. Short termism is the incessant hunt for money managers to hold the shares of companies to boost their market valuation. The metric moves in the direction opposite to the production of goods and services and in-house innovations to boost productivity and, thereby, the remuneration of workers.

With Option D, money is a store of value because it is identified. The central bank is a narrow bank. Deposits are perfectly safe unlike deposits with commercial banks that are subject to credit risk. The central bank would secure the deposits of its citizens by backing them by government bonds as illustrated in the next section. In our formulation, we strike an equivalence between government bonds and work and production in what can be called a Real Bonds Doctrine. The central bank would have direct control of credit. The monetary authority would have the mandate of reaching credit and employment targets. Once the objectives

are specified, criteria would have to be set to provide funds to banks, specifying acceptable credit risk ranges, the collateral requirements to be expected of borrowers and so on. The tracking of monetary transactions would reduce the possibility of evasion. Chosen transactions can be enforced or discontinued. Blockchain technology can be used to introduce smart contracts, algorithms that enact the terms of contracts. For instance, the CBDC can be programmed to allow real estate transactions within 'bubble/crash bounds' or for the automatic payments of loans. A deep link in the connection between bank and central bank is trust (Tymoigne, 2017). Trust in government is the ability of the latter to impose and collect taxes. That power is credible as long as the government, through the instrumentality of the central bank, supports the emission of wage income to enable workers to pay their income taxes. For banks as well, trust rests in the ability to impose their debt on others. The Post Keynesian meeting ground between the State and Credit views alluded to rests on the monopoly of debt issue and destruction of both banks and central banks. To that end, counterfeiting cannot be countenanced.

2.3 The "third moment"

The "third moment" is the closing of accounts. Infinite planning horizons are a heuristic device. Individuals plan to maximize their utilities over their lifetimes. In mainstream macroeconomics, a transversality condition would be added to the expressions in our equations. As time tends to infinity, savings with the central bank and returns on outstanding loans would tend to zero. It would be more appropriate to use the roughly equivalent expression 'No Ponzi Games' to characterise the terminal value condition of the *FM* expressions on the right-hand side of equation 11, a catchall for company shares at one end to options, futures and the like, plain vanilla and exotic at the other. The only salient feature about the overall arrangement is that a Chinese wall separates this term from the others. Bubbles and crashes will have no impact on the narrow banking or investment banking segment nor will they fall under the responsibility of government in the form of insurance or bailouts. Martin Shubik, the founder of "mathematical institutional economics", a structural process language different from General Equilibrium models has proposed default algorithms members of society could be party to (Qin, Quint and Shubik, 2017). Government is another player in the market game with the ability to set bankruptcy penalties. For instance, if a calibrated penalty is set, strategic default will be avoided. Trust also arises in the need for a centralised ultimate auditor rather than completely decentralised clearing arrangements (Aaron, Rivadeneyra and Sohal, 2017). Central banks are naturally positioned to provide finality, the certainty of settlement, and the stable value of money. Unlike other systems, central banks would be able to maintain the value of their tokens via the conduct of monetary policy.

3. The circuit in time

Since central banks were singled out as the best from among the rest of banks, the direct association of central banks with cherry picking projects should not be surprising. Indeed, their special status is underscored when banks are paralysed by Keynes' "dark forces of time and ignorance" that are implacable during a great recession. Already referred to, problems of private information plague borrower and bank and one possibility is the inefficient outcome of blue-eyed borrowers being rationed and dud projects being selected. Central banks can at least commandeer large, green projects employing millions of hands which in any event would have been outside the calculus of consortia of banks being high risk-low return. A protracted recession is akin to an extraordinary event like a war which has always been the launching pad for the takeoff of central banks. Antipa&Chamley (2017) have hand collected data on the French Wars (1793-1815) to depict the pivotal role played by the Bank of England then. It purchased large quantities of both private and public debt so as to grant sufficient liquidity to the system. The expansion in its balance sheet on the first account has been called the Real Bills policy. Thus, discounted bills backed goods in process unlike the subsequent discounting of government securities that were backed by future taxes. At some point in the period, in contrast to bills issued, bills purchased were not connected with specific taxes. The Bank was sensitive to systemic risk by ensuring that the sum of bills issued and purchased equalled the total number of bills permitted by Parliament and therefore backed by future taxes. The goods were produced and sold and the demand for credit correspondingly decreased, the notes and discounts falling *paripassu*. Such a dispensation could not be inflationary. The low level of prices in contrast to the quantum of Bank notes outstanding reflected the veracity of the Real Bills doctrine. To repeat, Bank notes represented goods and services produced by the private sector or taxes collected by the government. Prices increased only when the fiscal balance deteriorated after 1808. Symmetrically, prices fell with the fall in war-related government expenditures well before the quantity of notes in circulation declined. The balance sheet of the Bank hugely increased but the composition mattered more than the magnitude. England's first income tax to the extent of 60% was inaugurated then, signalling the commitment to an eventual fiscal equilibrium. All citizens believed they were contributing to the war efforts. Recall that the Bank of England was not a central bank in the sense understood today. It was created in 1694 to protect business interests in general and bondholders in particular. Carlin and Mann (2017) have painstakingly collected physical data on variations in output across counties in the US during the 1920s. When the Federal Reserve began operations in 1914, national banks were required to join. State banks were not required to and, indeed, most demurred as the benefits of the discount window operations were believed to be more than compensated for by the reserve ratios and the requirement to hold stock in the Fed. The scholars focus on agriculture in Illinois in the early 20th century. They discover a Fed credit

channel separate from any effects of the money supply. Counties with higher Fed membership experienced higher relative growth during 1920-1926.

Coming to the present, a fillip from Europe is provided by Cesaratto (2017) who avails of macroeconomic truisms to note that the plan for Greece to depend on domestic rather than foreign savings and, thereby, escape from the grip of foreign indebtedness must mean a strategy to avail of domestic savings which, in turn, implies a regime of financial repression. A government-led movement out of the pit of a recession would include a proactive industrial strategy that would have to be complemented by State control of the banking system.

Our proposal can be interpreted as a flip of the "single-circuit sovereign monetary system" proposed by Huber (2017) where, in the spirit of asset–based reserve requirements, the central banks would operate with the assets side of banks' balance sheets where the latter intermediate, at best, the electronic transfer of wages to the accounts of workers. There would be narrow banks confined exclusively to payments services. On the other hand, the motor force for bank money would be the nexus between banks, firms, and workers able and willing to assume asset-debt positions as the central bank would be willing to create primary credit. This Chinese Wall would be of benefit to narrow banks untrammelled by the risks attendant on the other side of their balance sheets. The following incentive would be attenuated. It has been pointed out that the Fed's official monetary aggregates did not account for the effects of the computerized sweep programs in the 1990s by means of which banks reclassified their customers' demand deposits as funds held in the form of highly-liquid assets so as to escape statutory reserve requirements (Belongia and Ireland, 2017). Customers were none the wiser.

4. Conclusion

We provide a nonstandard but consistent account of the construction of a firewall between virtuous and potentially vicious circuits of economic activity. The base and the apex of the system is the central bank of the country which simultaneously ensures liquidity at all times and assumes large social risks beyond the ability of financial and non-financial entities to bear. Accordingly, the familiar unravelling of arrangements in the past does not apply. Glass-Steagall and other walls crumbled as participants on the 'long' side dreamt wistfully of the greener grass on the other side of the wall, the 'short' side. The arbitrage principle cannot be escaped. Secondly, hemmed in by rate restrictions on their own turf, commercial banks soon turned out to be loss-making entities. The central bank is not in the business of making profits. At the same time, a profound accounting principle applies inexorably. Central banks cannot write off non-performing loans with the stroke of a pen. Money backs the wage in the 'first moment'. The objective is regular employment at an average wage from a regular stream of hand-picked projects. Thereafter, as the closing of accounts in the 'third moment' is approached, the originators, the central bank and the firm and the workers, will need to get into a huddle to decide on termination conditions. Moral hazard and other disincentives will have no bearing on the process as the switching on of another circuit is an independent act. Concluding as we began, with digital currencies, a touted merit of bitcoin has been the absence of the need of a clearinghouse, known or virtual. Indeed, the identity of the founder Satoshi Nakamoto was never known and he/she/they are regarded as moving in 2011 to other pastures. We regard this 'black hole' as a fundamental flaw in the arrangement as it ignores the past and present of all monetary arrangements. Even extreme advocates of free banking asked for no more than the central bank to clear accounts at the end of the day. Schemes like Keynes' International Clearing Union retain their appeal because of their 'doability'.

References

Aaron, M., Rivadeyneyra, F., & Sohal, S. (2017). Fintech: Is This Time Different? A Framework for Assessing Risks and Opportunities for Central Banks. *Bank of Canada Staff Discussion Paper*.

Antipa, P., &Chamley, C. (2017). Monetary and Fiscal Policy in England during the French Wars, *Banque de France Working Paper #627*.

Belongia, M. T., & Ireland, P. M. (2017). Circumventing the zero lower bound with monetary policy rules based on money, *NBER Working Paper 23157*.

Bichler, S., & Nitzan, J. (2016). A CasP model of the stock market. *Real-World Economics Review, (77)*, 119-154.

Bordo, M. D., & Levin, A. T. (2017). *Central bank digital currency and the future of monetary policy* (No. w23711). National Bureau of Economic Research.

Carlin, B. & Mann, W. (2017). Finance, Farms, and the Fed's Early Years, *NBER Working Paper 23511.*

Cesaratto, S. (2017). The nature of the eurocrisis: A reply to Febrero, Unò and Bermejo, Università di Siena, *Quaderni del Dipartimento di Economia Politica e Statistica no 752.*

Cochrane, D. T. (2016). Disobedient Things: The Deepwater Horizon Oil Spill and Accounting for Disaster, *Working Paper on Capital as Power No 2016/05.*

Claeys, G., Demertzis M., & Konstantinos, E. (2018). *Cryptocurrencies and monetary policy, Committee on Economic and Monetary Affairs*. European Parliament, Monetary Dialogue.

Cutsail, C. & Grubb, F. (2017). The Paper Money of Colonial North Carolina, 1712-1774, *NBER Working Paper 23783.*

Dabrowski, M., & Janikowski, L. (2018). Virtual currencies and their potential impact on financial markets and monetary policy. *CASE Research Paper*, (495).

Dafermos, Y., Nikolaidi, M. & Galanis, G. (2017). Climate change, monetary policy and financial stability, *Post Keynesian Economics Study Group Working Paper* 1712.

Dodd, N. (2017). The Social life of Bitcoin. *LSE Research Online, Theory, Culture and Society.*

Dow, S. (2018). Monetary Reform, Central Banks and Digital Currencies, University of Victoria Economics Department Discussion Paper DDP1805.

Engert, W. & Fung, B. S.C. (2017). Central Bank Digital Currencies: Motivations and Implications, *Bank of Canada Staff Discussion Paper* 2017-16.

Fung, B. S. C., &Halaburda, H. (2016). Central Bank Digital Currencies: A Framework for Assessing Why and How, *Bank of Canada Staff Discussion Paper* 22.

Godley, W. & Cripps, F. (1983*). Macroeconomics.* Oxford: Oxford University Press.

Gouveia, O. C.; Dos Santos, E., de Lis, S. F., Neut, A., & Javier, S. (2017). Digital Central Bank Currencies: assessing implementation policies and impacts, *BBVA Research Working Paper* 17/04.

Heller, D. (2017). Do digital currencies pose a threat to sovereign currencies and central banks?, *Peterson Institute for International Economics Policy Brief* 17-13.

Huber, J. (2017). Split-circuit reserve banking-functioning, dysfunctions and future perspectives. *Real-world economics review*, *80*, 63-84.

Niepelt, D. (2018). Reserves for All? Central Bank Digital Currency, Deposits, and their (Non)-Equivalence. *Cesifo Working Paper* No 7176.

Tymoigne, E. (2017). On the Centrality of Redemption: Linking the State and Credit Theories of Money through a Financial Approach to Money, *Levy Economics Institute of Bard College Working Paper* No 890.

Qin, C. Z., Quint, T., &Shubik, M. (2017). Default, Efficiency and Uniqueness. *Cowles Foundation Discussion Paper* No 2095.