FREEWORK

COLLABORATION WITHOUT BARRIERS

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FreeWork Culture

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ABSTRACT: Money, when it comes down to it, is a tool for collaboration. Money moves human energy, skills, and time between us, in different "containers", or stores of value. Many developing countries struggle to achieve effective collaboration between layers of society and economic sectors. A build-up of missed growth occasioned by an inability to steer the economy back to its growth curve following several recession cycles, the pressure from population growth, globalisation and free market trends, threaten to perpetuate untractable poverty and futility in many cases. Following the 2008 economic crisis, emphasis on rules that promise to deliver better performance as measured by stability in output and prices, implemented by targeting of some nominal quantity and drawing upon modern computational capabilities emerged. A computational framework with access to the necessary information regarding changes (or predicted changes) in factor supply is well capable of precisely enforcing the monetary protocol indiscriminately. Theoretically, such a paradigm challenges the existing fiat regime regarding which base money (or monies) to receive and to offer in exchange for deposit credits or notes and opens up the space for crypto-currency/assets, tokens, derivatives and commodities to act as base-money in national or denationalised country systems. In practise, blockchain technology will become an enabler to both financial sector and central banks in developing broad-based banking system that support an especially stable relationship between the new stock of base money on the one hand and the level of spending (or NGDP) on the other.

We present the advantages of the system; outline the requirements and goals, as well as the architecture of a valorisation eco-system. In addition, we present the results of a FreeWork case study that involves over xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx.

Keywords: value stream, production, food, energy, water, labour, HR, remittance, payment, cash transfer, blockchain, smart contract, ethereum, mobile payment, stablecoin, cryptocash

Table of Contents

On September 25th 2015, countries adopted a set of goals to end poverty, protect the planet, and ensure prosperity for all as part of a new sustainable development agenda.

Each goal has specific targets to be achieved over the next 15 years. For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and

people like you.

INTRODUCTION AND CONTEXT

The traditional framework for the injection and flow of resources in countries is primarily through use of country systems and private sector participation. For the later, this is a trivial feat in competitive market economies where goods and labour move freely. As to the former, the use of country system is fundamentally bounded to the principal-agent dilemma. It is not assured that governments will be honest, efficient and diligent resource administrators and this has important influence in the overall performance of factor productivity. A capital goods supplier is not assured that its resource allocation will be efficiently applied and of return on investment and or any recourse thereof. A labour supplier is not assured that their resource allocation will have equal opportunity, fair compensation and long-term prospects.

The persistence of this threat even when they can be reasonably accounted for within the cost of doing business and mitigated poses the hypothetical conclusion that – Factor productivity, lacks sufficient incentive that motivates them to ignore the risk, peril and hazard posed by the principal-agent dilemma.

As pressure mounts on political, economic and scientific leaders to deliver inclusive growth and shared prosperity, the contribution of this whitepaper is to layout the approach to use of socioeconomic sovereignty to correct structural imbalances and rehabilitate economies.

In the paper:

We establish sufficient conditions that resolve the principal-agent dilemma.

We evaluate decentralised incentive systems as a proven resource mobilisation and allocation strategy.

We outline a simple intervention model for autonomous monetary and socioeconomic agents to grow rate of real factor inputs – labour and capital, which induces capacity-generating productivity, consumption and wealth in closed or open economies.

We find that under certain simplifying assumptions and plausible conditions, socioeconomic agents interacting autonomously are able to establish mechanisms to unlock income earning and wealth accumulation that may indeed dominate country systems in delivering quality growth and shared prosperity in the places that need it most.

In the paper we evaluate use of socioeconomic sovereignty as an alternative socioeconomic monetary policy target for open and closed eceonomies.2 If one can adopt these two paradigms, and in a world desperately looking for a killer app, what follows? Now that we know that it is possible to collaborate freely, to move human-skills and capital openly, and expediently participate without barriers and “what if?” fears from another era/error, what do we do?

Section 4: We present the system-engagement processes of the FreeWork system its applications and discuss future directions of the system

The section proceeds as follows: after the introduction,

Section 2 sets up a simple general equilibrium model and proves general conditions under which aggregate demand and supply can be derived separately for both static and dynamic models.

Section 3 provides a simple demonstration of how altering preferences to make the conditions hold can alter the result of the model.

Section 4 discusses how restrictive the conditions are, Section 5 extends the results to some interesting special cases, and Section 6 concludes.

In this section, we objectively derive the form, feature and implementation of crypto currency and demonstrate sufficient and necessary conditions compatible with Mises's regression theorem.

1. A MECHANISM FOR COLLABORATION

> *"The theory of the value of money as such can trace back the objective exchange value of money only to that point where it ceases to be the value of money and becomes merely the value of a commodity. If in this way we continually go farther and farther back we must eventually arrive at a point where we no longer find any component in the objective exchange value of money that arises from valuations based on the function of money as a common medium of exchange; where the value of money is nothing other than the value of an object that is useful in some other way than as money. Before it was usual to acquire goods in the market, not for personal consumption, but simply in order to exchange them again for the goods that were really wanted, each individual commodity was only accredited with that value given by the subjective valuations based on its direct utility."*
>
> *Mises's Regression Theorem*

Money, when it comes down to it, is a mechanism for collaboration. Money moves human energy, skills, and time between us, in different "containers", and stores its value. When you control the money, you control everything– markets, prices, risk, investment, savings, rates, hiring, wages, sovereign debt, housing starts, etc.

The commodity value of fiat money is the underlying normative belief in the government (agent) to always act in the best interest of the commonwealth (principal). This is so because (1) all fiat currency is established by governments, and (2) the strength of this belief is directly proportional to the fiat power of the country, as observed in ICP-2011[i] between countries and their contemporaries. In as far as, factor productivity (principals) withhold their collaboration (money) because they are not convinced that a counterparty (agent) will not succeed in acting undetected contrary to their interest; the challenges to mobilising resources for global socio-economic growth and development can be perceived in terms of the principal-agent problem.

The commodity value of digital cryptocurrency is the governance implemented in the source code of the digital cryptocurrency. This protocol reliably asserts that a player in a game cannot make a credible threat to disregard a later action that will not be in their interest when the time comes to take the action. Absent that threat, a player in a game has much to gain from the ability to commit in advance. In the digital cryptocurrency ecosystem, users (principals) exchange their collaboration (money) because they are not convinced that a counterparty (agent) will succeed in taking a later action undetected contrary to their interest.

In this section, we objectively derive the form, feature and implementation of crypto currency and demonstrate sufficient and necessary conditions compatible with Mises's regression theorem.

2. LETS MAKE COLLABORATION

The discussion around digital cryptocurrency and the regression theorem usually focuses on whether cryptocurrency has some intrinsic worth (non-monetary use). If digital cryptocurrency is intrinsically worthless, the regression theorem is invalid, meaning an object may become money despite lacking a non-monetary use at the outset. If cryptocurrency has some non-monetary use at the outset, the regression theorem remains intact.

(a) In terms of the principal-agent problem.

Almost every aspect of socio-economic life is a collective action problem, so much so that the normative scope of social science might be described through the principal-agent relationship. The principal is one who, within predefined terms, assigns a task to an agent, who performs the task on the principal's behalf. If the agent's incentives are not aligned with those of the principal and the principal cannot monitor the agent's actions, the agent has both the motivation and the ability to act undetected against the principal's interests. This scenario is referred to as the "principal–agent problem." It is important to assert that the entire digital currency ecosystem is a decentralised incentives market place. Participants have a free predictable choice of incentives (block rewards and transaction fees) or penalties (mining equipment and electricity). Network interactions are associated with economic approval. Anticipation of economic sanctions has important network consequences under the proof-of-work/stake matrix. It is observable that: (1) The ecosystem is yet to experience a "hard-fork" or substantial slowdown that is attributed to rational attacks, (2) The protocols keeps performing according to specification, even though mining pools would be able to launch collaborative attacks given the power they control. (3) The natural incentives (expected revenue of miners) and high monetary value can explain why miners keep mining given the plausibility of attacks

The above being true, then the assertion that "the digital currency ecosystem's implementation of blockchain technology reliably solves the principal-agent problem" holds.

(b) In terms of The Value of Research

The typical way we have to evaluate the impact of research in economics and any other sciences is to count citations, and possibly weigh them in some way, (except maybe where patents are relevant). However, this only evaluates how the research output is viewed within a narrowly defined scientific community. Nederhof and Meijer (1995) argue that research does

not improve living conditions directly, but that research results need to be transferred to users outside the science system to generate useful applications.

Hofmeister (2011) VA-index method allows to assess research performance in terms of utility by combining the value of applications with the corresponding shares of research influence. The VA-index distributes the value of all applications that embody research to the works of research which the applications directly rely on, and further to the works of research of previous generations which the authors of the immediate reference sources have directly or indirectly made use of. Based on the flow of scientific results, a value-added (VA) index is developed that can, in principle, be used to assign a monetary value to any research result and, by aggregation, on entire academic disciplines or sub-disciplines.[ii] It is an interesting way to properly attribute the intellectual source of a new product or process, but the exercise is of little value if it is not possible to quantify the social value of the end-application.

Distributed computing is a contemporary order conceptual framework that continues to be researched in broad scientific spheres. Spin-off implementations such as blockchain technologies and digital currency and their contribution to social welfare offer an interesting perspective from where to evaluate and quantify the social value of the end-application. As of writing, 1300 Cryptocurrencies traded in 6735 Markets have a total Market Capitalisation of $232,443,124,567 volume traded in the last 24hrs is $7,666,590,179 the single largest counter is BTC with a Dominance of 55.4%. The experiential evidence makes it therefore possible to evaluate the end-application from a social-value proposition and draw sufficient conclusion.

Transfer of knowledge to users outside the science system can therefore be regarded as final product of any scientific endeavour.

The above being true, then the assertion that “market capitalisation of cryptocurrency reliably validates as important and viable, generations of scientific-research works to create techniques and systems that produce allocations that are normatively acceptable” holds.

This section outlines a method whereby consistent with the foregoing conclusion sufficient and necessary conditions are established that support unconstrained allocations of factor productivity.

3. EXPECTATIONS AND COLLECTIVE ACTION

It is a basic human right of every person, acting on their own volition and without discrimination or exploitation, to work and undertake trade, industry and innovation.

It has been two years since the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda officially came into force. With these new Goals, the universal call to action is for all countries to collaborate in correcting the structural imbalances in their countries that have given rise to intractable poverty, inequality and climate change, while ensuring that no one is left behind. The adopted blueprint sets out 17 areas in which a lump sum allocation of factors of production – labour and capital, is required to achieve the goals.

While the SDGs are not legally binding, governments are expected to take ownership and establish national frameworks for their achievement. This bears two propositions therefore:

1. It is imperative to solve the principal-agent problem in order to efficiently mobilise and allocate factors of production so as to achieve the 17 sustainable goals for development.
2. The challenges to mobilising global collaboration for socio-economic growth and development can be perceived in terms of the digital cryptocurrency solution.

4. MAKE COLLABORATION

Human Capital Accounting

Just as physical capital is created by making changes in materials so as to form tools that facilitate production, human capital is created by changing persons so as to give them skills and capabilities that make them able to act in new ways." (Coleman, 1990, 304).

Human capital accounting models attempt to resolve the principle question of, whether to measure proactively the potential value, or retroactively the realised value of human resource. Considering that autonomous consumption aggregates provides that human capital will always incur a marginal cost to the system whether it is in operation or not. This provides a significant basis to choose to account proactively and further develop an indexing system that motivates unlimited realisation of that potential.

Theoretic Synthesis

Consider a competency framework index made up of the following four components' contribution to labour factor input:

Talent: All human resources are bestowed upon them certain abilities, characteristics, and wherewithal that enables them to be positioned distinctly from one another. Factors that directly affect estimations are (a) the minimum threshold, (b) the number of simultaneous abilities, (c) a conjunctive or disjunctive definition of abilities, and (d) the correlations between the various abilities assessed. A tensor flow object allows the simultaneous manipulation of various values of the four parameters and observe how they affect the theoretical prevalence of gifted and talented individuals.

Experience: All human resources encounter natural, influenced or deliberate phenomena that leave strong impressions in the individual and that correlates distinctly with developmental changes in the individual. This are the individuals experience represented in eight seven-year cycles in a lifetime and the minimum accounting age is 14 years.

Qualifications: All human resources attain levels of development that is measureable and can be validated through a formal merit system from {primary, secondary, a-tertiary, certificate, diploma, under-graduate, post-graduate, doctorate}.

Reputation: All human resources attain recognition for idiosyncrasies that are important to the market. The ability to establish the degree of the binding between nodes on the network will cause the emergence of a decentralized fault-tolerant web of confidence for all nodes. This web of trust will self-administer introductions, vetting and endorsements of users based on trade, social and networking encounters.

Formal Description

Let T be the talent identifier, estimated using the general function of the multinormal distribution (Johnson & Kotz, 1972) below

$$f_k(X) = (2\pi)^{-k/2}|det(C)|^{-1/2}\, exp\left[-\frac{1}{2}(X - mu)^T \quad C^{\{-1\}} \quad (X - mu)\right]$$

Where:

1. "k" is the number of simultaneous abilities considered.
2. X is the minimum threshold selected in z scores for the set of k abilities. In this case the matrix allows a different selection ratio for each variable k.
3. C and |C| is the correlations between the abilities. In this case the matrix represent the matrix of covariances between all variables () and its inverse respectively.
4. The conjunctive prevalence (%Cj) corresponds to the product of the selection ratios.

$$[Cj\% \;=\; SR * SR * SR \ldots].$$

5. The disjunctive prevalence (%Dj) is computed by subtracting those who are not identified in a single ability domain from the whole population

$$[\%Dj \;=\; 1 - ((1 - SR) \;*\; (1 - SR) \;*\; (1 - SR) \ldots)].$$

Let Q be qualifications, a given quantity.

Let E be the experience identifier, a given quantity, various estimates suggest that, each additional year raises workers' productivity at a given level of education by about 10 percent.

$$\{[15:21], [22:28], [29:35], [36:42], [43:49], [50:56], [57:63], [64:70]\}$$

Let R be reputation identifier, an estimated quantity given by the sum of transitivity_coefficient, local_clustering_coefficient, global_clustering_coefficient, (ratio of in_degree_centrality to out_degree_centrality), and PageRank, estimated with standard, transitivity, clustering, centrality and PageRank expression and on dynamic runtime data.

Defined in this way, we can therefore express the human-capital-adjusted labour factor input as in a trivial summation:

$$H = T + R + q^{(0.1E)}$$

It is also further possible to expand this derivation using a tensor object.

Implementing the Work Model

KAZINI.WORK

KAZINI.WORK is a multi-agent process, control and integration framework as an ethereum decentralised application. It enables a methodical, functional and procedural approach to undertake projects that are difficult or impossible for an individual agent or a monolithic system to solve. It provides a human-machine interface to a smart contract logic that allows anybody to create projects, interpret these projects into work, schedule the work into tasks, allocate the tasks to agents, incentive agent actions to complete the tasks and generate and distribution an ERC20 token to all the agents involved in the specific project.

Its intended use is in:

1. Deciding what to do and initiating how it will be done; this is the planning function. This involves any agent(s) setting a purpose or goal and establishing the objectives for achieving it consistent with higher-level individual goals, resources, and constraints in the environment.
2. Arranging for the work to be done; this is the organizing function. This involves mobilising any agent9s) to (1) recruit, train, and assemble in teams with specified authority, responsibility, and accountability relationships; (2) acquire and allocate facilities, materials, capital, and other resources; and (3) create an organization structure that includes policies, procedures, reporting patterns, and communication channels.
3. Directing and motivating agent(s) to attain the goal. This is the leadership function. The framework influences the work performance and behaviour of workers and groups, through finance, accounting and settlement, and agent-rating and certification.
4. Monitors work performance with respect to the goal and takes necessary action whenever work begins to deviate from the goal; this is the control function. For effective control, the system tracks information about performance with respect to costs, schedules, and goal criteria. It interfaces with remediation and enablement services such as rehabilitation, welfare and career service organisations
5. Assessing the four functions to determine how well they, the functions, are doing and where change is needed, either to the goal or to the functions themselves.

The setup comprises:

1. A library providing the multi-user agent system objects and deployed as a smart contract on an Ethereum public node.

    a. Agent types: individual, corporate, biological, physical
    b. Agent roles: owner, manager, member, team
    c. Agent attributes: identity, competency, specification, edges
    d. Agent functions: identify(authenticate), endorse(sign), secure(encrypt), revoke
    e. System operations:
        i. Initiating
        ii. Configuration: planning, scheduling, budgeting, organisation
        iii. Direction: integration, control, tracking, communication, negotiation
        iv. Resourcing: resource acquisition, allocation and accounting
2. Agents are "cognitive objects" interacting according to rules formulated to achieve deterministic behaviour and social interactions based on incentives, information and optimisation in the environment. Rules guidelines:
    a. Agents have roles based autonomy
    b. Agents have competency based local views
    c. Agent actions have strict performance impositions
    d. All promises are revocable with penalties
    e. All commitment are irrevocable
3. Projects are “endeavours” created by agents. These set off a chain of agent behaviour and activities geared at delivering on the project goal. The agent environment is constrained by accessibility, discreteness, intertemporality and dimensionality.

The owner provides the initial requirement (purpose/goal) of a project. The manager configures the purpose/goal into a project using a system-development-cycle approach. Members are free to place bids to undertake the defined tasks based on their competency matrix Teams are free to place bids to undertake the defined tasks based on their competency matrix. Kazini.work framework’s self-organisation and self-steering control paradigm is the mediation (middleware) that governs agent actions, task integration and resource access. System events are compelled by agent signals, incentives, interactions and information with imposition of increasing returns to scale conditions. The project then develops over time as an abstraction of a multi-agents system in a self-orchestrating organisation without further intervention.

5. EXCHANGE COLLABORATION

Recent advocates of rules for monetary policy have called for the close pegging of a variety of nominal indicators – monetary aggregates, commodity price indexes, the consumer price index, exchange rates. It seems fair to say that the consensus today favours nominal income as the most suitable object of monetary policy. In this case, the monetary agent establishes a target level or growth rate of nominal economic activity within a currency zone (usually a single country) for a given period without adjusting for price level changes (inflation/deflation). Policy is loosened or tightened as needed to hit the target.

A "market-driven" monetary regime is one where there is free entry of socio-economic agents and that are rewarded based on their skill at orchestrating activities that translate to on-target nominal GDP growth. It is necessary to induce market participants to make socially constructive decisions— that is, to engage in capacity-generating purchases, sales and investment, that are expected to lead to on-target growth in nominal spending.

Stylised Facts

Meade (1978), Weizsiicker (1978), Tobin (1980). Bean (1983) developed a formal analysis of the implications of nominal income stabilization in a general equilibrium macro model.

Hayek and market monetarists are concerned with a policy that would keep monetary equilibrium and therefore macroeconomic stability. Hayek's Rule (as labelled by Gustavson) and NGDP Targeting describe Hayek's and market monetarism position respectively.

Sumner argues that "NGDP level targeting (along 5 percent trend growth rate) in the U.S.A prior to 2008 would similarly have helped reduce the severity of the Great Recession."

Taylor (1985) concentrated on dynamic aspects of nominal income targeting.

McCallum (1988) made two important contributions to the recent literature on stabilization. First, he stressed the need for robustness in policy rules. Second, McCallum focused on a policy rule to which the central bank could be held precisely accountable.

Following what Selgin calls the "productivity norm," alternative monetary policies focusing on nominal income rather than price level stability, such as NGDP (Nominal GDP) Targeting and Hayek's Rule, have been proposed as better options.

Hall's (1994) income targeting model and further discussed and applied in Selgin (1988) and Cachanosky (2014), find a reasonable professional consensus on the proposition that a good, if not precisely optimal, rule for monetary policy is to target nominal income.

Murphy offers a comparative institutional analysis between NGDP Targeting and free banking.

Theoretic Analysis

a. Characteristics of Rules

A policy rule defined by the choice of indicator, the location and width of the band requires the monetary agent to keep the designated indicator within the prescribed band. In evaluating the desirability of a particular rule, there are four principal characteristics to consider.

Efficiency. A good policy should deliver the minimum amount of price variability for a given level of employment variability as well as deliver satisfactory performance across a wide spectrum of macro models.

Simplicity. A rule that is simple has a better chance of adoption in the first place and a better chance of continuing to be enforced.

Precision. Under a precise rule, there can be no doubt whether the monetary agency is adhering accurately to the set rule.

Accountability. A monetary policy is more credible if the agency responsible for monetary policy can be made accountable for achieving the policy. Under an accountable rule, there is no doubt whether the monetary agency is faithfully undertaking its role.

b. Proposition on the Form of Rules

A Productivity Norm

The term "productivity norm"[iii] is associated with the idea that the price level should be allowed to adjust inversely to changes in productivity. If productivity increases, the price level (P) should be allowed to fall, and if productivity falls, the price level should be allowed to increase. A general increase in productivity affecting the economy at large changes the relative supply of goods and services with respect to money supply. Therefore, the relative price of money (1/P) should be allowed to adjust accordingly. In other words, money supply should react to changes in money demand, not to changes in production efficiency.

Under the -- "Total Factor Productivity Norm TFP" rule as proposed by Selgin — monetary authorities target a nominal income growth rate equal to the expected growth rate of real factor inputs. Such a nominal income target would monetarily accommodate the real output effect of factor input growth, but not productivity growth and therefore allow the price level to inversely reflect both shocks to and anticipated changes in productivity.

The TFP norm will require stabilizing the nominal income of an index of labour and capital weighted for its share of the cost of production. An increase in K/L will result in an upward adjustment of nominal wages and a fall in rent to capital rather than a fall in the cost of capital alone. Even if there is a change in K/L but not in productivity, the productivity norm

is equal to a zero inflation rule. In theory, then, the productivity norm stabilizes the prices of factors of production (labour and capital). In practice, this principle is associated with stabilization of nominal income of factors of production. Therefore, monetary equilibrium requires that nominal income grows at the same rate as the supply of factors of production.

One of the attractive features of productivity norm-inspired monetary policy rules is the emergent potential outcome of a free banking system, one defined as a market in money and banking with no central bank and no regulations. Among the conclusions of the free banking literature is that monetary equilibrium yields a stable nominal income.

Growth and the Level of Real Activity

NGDP targeting can be formulated in terms of either levels or rates of change. A possible advantage of targeting a level is a faster return to the goal. If the regime is credible, an incipient shortfall in the NGDP level (or price level) engenders expectations of a subsequent monetary expansion and higher inflation, thus automatically contributing to lower real interest rates and an accelerated move towards the goal. The disadvantage of targeting a level is that the public may not fully understand, comprehend or believe a target in levels as it would a target in growth rates.

NGDP level matters, but its composition matters as well. Nominal income must be channelled to produce goods and services that consumers want, and they need to be produced with a sustainable technology of production. Salter's critique is that an NGDP Targeting rule may overlook this problem by focusing on nominal income as a target and not as an emergent outcome of the market. In other words, NGDP Targeting-type rules should not confuse cause with effect. That a sound and healthy economy yields a stable NGDP does not mean that to produce a stable NGDP necessary yields a sound and healthy economy.

The execution of the policy to target the appropriate level of NGDP directly affects the allocation of resources, depending on the injection points of money supply. An increase in money supply defines, at least in the short-run, the effect on relative prices and, as such, the relative efficiency in allocation of factors of production7. The starting point where the increase in money supply enters the market affects the path it will follow until it reaches the whole economy producing different effects on relative prices. Under free banking the injection points of changes in money supply consist of those specific banks where changes in reserves occur along with changes in money demand and are part of the emerging market order.

Price Level

Monetary policy should promise to remove almost all macroeconomic uncertainty from the CPI and maximize consumers' welfare from money holdings. In general this calls for allowing prices of final goods to decline at a rate roughly equal to "the" real rate of interest (Friedman 1969). The productivity norm, by allowing the price level to decline secularly as productivity grows, comes closer to this ideal than price-level stabilization. Moreover, if the real rate of interest is equal to the rate of growth of real income (as has been roughly true historically and as is implied by standard models of optimal growth, e.g., Phelps 1961), the rate of deflation that maximizes consumers' welfare from money holdings will equal the rate of increase in per capita output, and will imply that factor prices are held constant. The productivity norm and the optimal quantity of money norm will then coincide.

As Bertil Ohlin (1937, p. 321) once observed, keeping revenues "from getting out of balance" with costs (and especially wages) so as to prevent "abnormally large or low profits and profit expectations" is more crucial to macroeconomic order in the short run than stability of the price level as such. Under the productivity norm aggregate (effective) demand will continue to be just adequate to buy the fruits of industry at prices covering their (money) cost of production, without causing that cost to alter over time except in response to growth in capital and population. In Wicksellian terms, the productivity norm manages, where stability of the price level fails, to keep interest rates at their natural levels.

Monetary Equilibrium

NGDP as a reliable proxy for monetary equilibrium rests on the assumption that the ratio of (T) total transactions to (y) output, (T/y) is constant or at least does not change significantly. In this case, the quantity theory of money (MV=Py) is the merging of Fisher's equation of exchange (MV=PT) and the Cambridge version (M=kPy), where k is money demand, or the proportion of real income that economic agents wish to hold in the form of money. The quantity theory of money takes (V) from Fisher's equation and (y) from the Cambridge equation.

As Selgin [33] notes, If new factors of production enter the market, as productivity increases the demand for money will also increase, requiring an adjustment of M to offset the fall in V (increase in money demand). For instance, an increase in labour population increases the total demand for money. The productivity shock and the increase in the supply of factors of production, both of which increase y, should be conceptually separated. P should fall only to the extent that y is affected by the increase in productivity, not by the change in the supply of factors of production. At a constant demand of money per factor of production, an increase in

the latter requires an increase in M to satisfy the increase in total money demand. It can also be the case that the elasticity of money demand to changes in monetary income is not unitary. If an increase in monetary income results in a more (less) than proportional increase in money demand, an increase (reduction) in money supply is needed to let the price level reflect only the increase in productivity; the isolated effect of change in money demand should result in an increase in money demand. In other words, a non-unitary elasticity of money demand to changes in nominal income has spill-over effects on V.

According to Evans and Thorpe [31], while it may be the case that in the long run T/y is stable, there is no reason to assume this ratio is constant in the short run, especially during a boom and bust. It is expected that during a boom the increase in investment makes the ratio y/T decrease. During the bust, for the opposite reason the ration y/T increases. The fall in investment has a delayed effect on y, therefore influencing different behaviours for P and V depending on the measure of economic activity employed. It is possible for a policy maker looking at the short-run aggregate demand function AD = C + I + G in the aggregate of net national expenditures (Y) function to see signs of monetary disequilibrium, for example, through the misallocation of resources as it's taking place even before NGDP is affected. The productivity norm rules provide a natural offset against aggregate demand shocks.

Commodity-Money System

One of the potential outcome of productivity norm-inspired monetary policy rules is a free banking system, one defined as a market in money and banking with no central bank and no regulations. In this instance, base-money is comprised of non-storable, storable overhangs and storable intermediate inventories all which are endogenous to the market process. The commodity-reserve issues fungible banknote-credits convertible to base-money in addition the base-money can be consumed or assigned to industrial uses.

The commodity reserve conducts operations to ensure that seasonal changes in the demand for convertible-money and seasonal movements in the supply of base-money do not necessitate adverse effects on the required elasticity of money supply.

For the regime under analysis, the extended equation of exchange as presented by Christensen, Beckworth, and Hendrickson [25,42,43] offers a reasonable solution to the money equilibrium problem. By opening M, the quantity theory of money can be adapted to show base-money (ß) and the money multiplier (π) under commodity-money system:

1) $MV=ßπV=Py$

Note that money supply (M) has two components, ß and π. Under free banking, both components are endogenous outcomes of the market process, which means that changes in money demand can be satisfied by either ß or π. Bank money, in this representation captured in $\pi < 1$, is endogenous to the financial markets. ß is endogenous to the market as a whole even if it is exogenous to the financial system. An increase in money demand can be satisfied with an increase in circulation of convertible banknotes (M) without the need for new ß resources through commodity-reserve policy operations.

An NGDP Level target will always be infinite relative to (π) the money demand, and as shown earlier, the productivity norm naturally offsets the money demand interactions with factors of production. Therefore, if the demand for cash balances by economic agents has a bandwidth of 0 to 1 of NGDP, setting a reserve ratio requirement where the money multiplier is $\pi < 1$, satisfies the elasticity and risk arguments between proponents of fractional reserve banking and 100-percent reserve requirement.

It is theoretically possible to have a large shock in the supply of commodity money under commodity standard monetary system, therefore, the relative price of money (1/P) should be allowed to adjust accordingly. If total factor productivity increases, the price level (P) should be allowed to fall, and if total factor productivity falls, the price level should be allowed to increase. Additionally, the intermediary bank's supply of base money (ß) should be at least as efficient as the supply of convertible banknotes. In other words, money supply should react to changes in money demand, not to changes in production efficiency.

Formal Description

Let $Py = wL + rK$

represent an economy's nominal income, where P is the general price level, y is real output, w is the price of a unit of average-quality labour, r is the rental price of average-quality capital, L is labour input, and K is capital input.

where $Y = A(K^{\alpha}H^{1-\alpha})^{\gamma}$

A is a total factor productivity, γ measures the extent of returns to scale, and α is capital's share of total income $\frac{rK}{Py}$. If $\gamma = 1$ ($\gamma > 1$) ($\gamma < 1$), there are constant (increasing) (decreasing) returns to scale, H is labour's share of total income.

The logarithmic differential of equation 1 expresses growth rates with respect to time and rearranging the variables: $g_Y = g_A + \gamma\,[\alpha g_K + (1 - \alpha)\, g_H]$

TFP growth can be written as growth in output less a weighted average of growth in inputs: $g_A = g_Y - \gamma\,[\alpha g_K + (1 - \alpha)\, g_H]$

where italics represent growth rates. A, then, is the growth rate of total factor productivity. y is real output growth. whereas a total factor productivity norm requires that $P = -A$ or, equivalently (from above) that: $P = -g_Y + \gamma[\alpha g_K + (1-\alpha) g_H]$

This sets the money multiplier (π = **VRR**) which reflects the money demand or the proportion of NGDP held in the form of money to an index of nominal income growth under a TFP norm. $VRR = LRR + CRR$

The Liquidity Reserve Ration is the sum of demand-liabilities $DL = (1-\alpha) g_H$ and time-liabilities $TL = \alpha g_K$ and is set to equal an index of labour and capital weighted for its current share of nominal income growth under a TFP norm. $LRR = \gamma[\alpha g_K + (1-\alpha) g_H]$

The rate of change of the Cash Reserve Ratio is equal to that of P under TFP norm.

$CRR = -g_Y + \gamma[\alpha g_K + (1-\alpha) g_H]$

1. An increase in the ratio of capital to labour K/L will result in an upward adjustment of demand liabilities share and a fall in time liabilities share of the LRR; the inverse is true.
2. A lower than expected NGDP growth rate would reduce the cash reserve ratio, boost the money multiplier, therefore boosting the broader monetary aggregates; the inverse is true.

   May need to cater for a sustainable debt dynamic rule here.

Implementing the Rules

The feedback from monetary change-purchases or sales of securities in exchange for reserves-to nominal income is notoriously slow. Proposals to stabilize nominal income through optimal control rules based on estimated causal relations between money growth and nominal income growth may lack robustness.

Control is most effective and least likely to result in instability when the variable under control responds quickly to the inputs.

Control rules must be biased strongly toward inaction in order to avoid the possibility of unstable feedback.

Policy rules-even those with desirable characteristics-have side effects. Keeping one variable under tight control may bring high volatility to other variables. Rules that make an intelligent choice between price and employment stability may require tolerance of large swings in interest rates and exchange rates. Yet if a policy rule is on the frontier of price and employment stability, such side effects should probably be ignored.

The central bank establishes a target level or growth rate of nominal economic activity within a currency zone (usually a single country) for a given period without adjusting for price level changes (inflation/deflation). Policy is loosened or tightened as needed to hit the target.

A “market-driven” monetary regime is one where there is free entry of socio-economic agents and that are rewarded based on their skill at orchestrating activities that translate to on-target nominal GDP growth.

Institutional Instruments

a. Forecasting

Since the goal is to hit the target for the coming period, some method of forecasting the default value of the target must be devised to serve as the baseline that indicates the direction and magnitude of policy change required to change the outcome to match that target. As far as monetary policy is fully committed to the nominal income target then the most important role of forecasts is to enforce the policy rules upon the monetary authority. We therefore propose a dual, both an inside and outside approach:

Agent-Based Computational Modelling

ACE models apply numerical methods of analysis to computer-based simulations of complex dynamic phenomena, facilitate the quantitative analysis of emergent agent behaviour and provide insight into causation, correlation and effects.

Its intended use in:

1. Forecasting the direction and magnitude of policy relative to baseline values that will produce the targeted level and structure of nominal income for a given period.
2. Constructing a theoretic explanation of emergent agent behaviour, such as: Why have particular global regularities evolved and persisted? How, specifically, have these global regularities been influenced through the repeated local interactions including learning from interactions? And why these particular regularities and not others?
3. Analyse for a particular economic mechanism, whether existing or simply envisioned, what are the implications of this mechanism for the performance of the economy as a whole? What socio-economic outcomes will result from the multitude of “this or that” and “now and then” decisions by agents with bounded rationality adapting to market forces? What macro and microeconomic specifications are necessary and sufficient to achieve equilibrium states?

The setup comprises:

4. a library providing the multi-user agent system object and deployed as a smart contract on an Ethereum public node.
5. the "agents" are "computational objects modelled as interacting according to rules" over space and time, not real people.
6. the rules are formulated to model behaviour and social interactions based on incentives and information.[2] Such rules could also be the result of optimization, realized through

use of reinforcement learning techniques.[3] The "agents" in ACE models can represent individuals (e.g. people), social groupings (e.g. firms), biological entities (e.g. growing crops), and/or physical systems (e.g. transport systems). The ACE modeller provides the initial configuration of a computational economic system comprising multiple interacting agents. The modeller then steps back to observe the development of the system over time without further intervention. In particular, system events should be driven by agent interactions without external imposition of equilibrium conditions.[20]

Potential issues include those common to experimental economics in general [21] and development of a common framework for empirical validation and resolving open questions in agent-based modeling.[22]

Consensus Forecast Market

Prediction and futures markets utilize the “wisdom of crowds” to derive the optimal estimate of the future path of important economic variables. Evidentially, it is difficult to effectively manipulate a prediction market as any attempt at market manipulation opens up profit opportunities to other traders, who would take advantage of a gap between the current market price of futures and their expected future price. Prediction markets can be highly effective a regime of “targeting the forecast,” or setting policy so that the expected growth in nominal GDP is equal to the target growth rate.

The setup comprises:

1. Decentralised consensus market place, exchanges, opinion polls and market arrangements for the sale of expert advice, and media dissemination of public forecasts with a wide distribution of the contemporaneous point forecasts for a given target around an influential "consensus" value.
2. Private firms such as Macroeconomic Advisers construct monthly NGDP estimates using the same monthly data series that the government relies on to compute GDP.
3. Whereas the consensus forecast reacts to portfolio changes in a few days or a week. It is possible to raise the level of its NGDP target, for instance by one basis point per day where the growth target was set at 3.65 percent, by constructing daily NGDP estimates by taking a weighted average of the data on a 31-day moving average from two consecutive months .
4. An NGDP futures market, with the commodity-reserve acting as the counterparty in all primary market transactions.

The market would function to achieve:

1. A link between investor sentiment, NGDP futures purchases and sales, and the quantity of money.
2. Adjustments to the monetary base to stabilize nominal GDP futures prices until the market predicts that the target will be met.
3. Provide real-time estimates of the likely growth in aggregate demand over the period
4. Provide information about the effects of monetary policy initiatives on total nominal output and about the price/output split.
5. Determine the origin of shocks whether they are primarily underlying or symptomatic

The nominal GDP futures contract structure:

1. The Fed would peg the price of NGDP futures at the targeted nominal income level for the period where it was the target of monetary policy.
2. The reserve would offer to buy or sell unlimited quantities of NGDP futures at a price equal to one plus the expected GDP growth rate, in parallel open-market operations for each NGDP contract purchase or sale.
3. When the contracts mature a year from today, their value will equal the ratio of next year's NGDP to current NGDP.
   Thus, if nominal GDP were to rise by 5 percent, the contracts would be worth $1.05. Those who took a long position would profit by $0.0135 per contract, and those who took a short position would lose that amount. If nominal GDP rose by only 2 percent, then those taking a short position would earn $0.0165 per contract.

The purchase and sale of NGDP futures contracts constitutes open-market operations that directly impacts the size of the monetary base and hence expected future NGDP.

1. Because each contract represent a market sentiment of above-target or below-target growth in NGDP, the reserve shall automatically proportionally reduce the monetary base each time an investor buys an NGDP futures contract, and similarly expand the base each time an investor sells an NGDP contract short.
2. Reaching a market equilibrium does not mean that each market participant expects on-target growth as in any market, there is a diversity of opinion.
   For instance, each $1 purchase of a long position in an NGDP futures contract might trigger a $1,000 open-market sale. A purchase of a $1 short position would trigger a $1,000 open-market purchase. In that case, investors would be effectively determining the

size of the monetary base. Traders would continue buying and selling NGDP futures until the money supply had adjusted to the point where the market expected NGDP growth to be right on target

In order to mitigate against exposure to default risk by futures traders and large trading capital requirements, will require each NGDP futures market participant will to money in a margin account.

1. The margin account shall suffice to cover any foreseeable move in actual NGDP, When the contracts matured, the money in the margin accounts would be returned to investors, plus interest, and plus or minus any gains or losses due to fluctuations in NGDP.
   Assume that each futures contract has a face value of $1,000, at maturity. Also assume that the total trading subsidy is $100,000, and that 50,000 contracts are traded, the trader also receives a share of the trading subsidy. Finally, assume that actual NGDP comes in at 1 percent above target, at 1.0465 times current NGDP. The contract for someone taking a long position is worth $1,000 × [(Actual NGDP)/ (Target NGDP)] and requires that investors place minimum 10 percent (or $100) in a margin account. The contract pays a competitive rate of return on the margin account, perhaps the one-year Policy Rate yield that is 5 percent. Each trader then receives a $2 trading subsidy for each contract. The total return for a long contract would be computed as follows: the $100 margin requirement would earn $5 interest, plus a $2 trading subsidy, for a total of $7. At maturity, the contract holder would also receive an extra $10 because NGDP came in at 1 percent above target. Thus, the initial investment of $100 would return $117 one year later, a gain of 17 percent. If NGDP had come in at 1 percent below target, then the total value of a long contract at maturity would be $97, a loss of 3 percent. The expected return is 7 percent, which by assumption is the amount needed to induce trading of 50,000 contracts.

Variable Reserve Ratio

Under free banking regime, the VRR is endogenous to the market process; changes to the multiplier affect the reserves portfolio that in turn constrains how open-market operations respond to money demand. A VRR set at a rate that reflects changes in the price level relative to the NGDP target advantageously allows it to interact accordingly to market expectations.

a. Open Market Operation

NGDP futures targeting essentially lets the market directly engage in open-market operations. Once the consensus to pegging the forecast of nominal income is achieved, all individuals and institutions would be allowed "free entry" to undertake open-market operations without need to designate a particular policy instrument. The investors could focus on the money stock, factor stock, interest rates, exchange rates, or whatever other variables they think would contain important information about future growth in NGDP and enter buy or sell contract as needed to keep the forecast at the peg. Using a computational framework to automate the process will ensure the market either predicts the optimal instrument setting or the market itself actually implements policy; the reserve assuredly rubber-stamps the market's decision simply and securely.

Distributed computing technology and particularly the Ethereum blockchain, a turing complete virtual machine capable of executing arbitrary instructions compiled as smartcontracts provides an excellent platform for achieving such automation. The market would then independently place buy/sell bids between the current market price of futures and their expected future price through individual contractual arrangements with the reserve smartcontract running on the ethereum virtual machine as the counterparty. The reserve open-market operations logic will interactively adjust the level of the monetary base and short-term interest rates until the market predicts that the NGDP target will be met. In practice The creation of automated OMO will require that, (1) A smartcontract design that allows free-entry for those interested in trading to do so successfully, (2) the market predicts the optimal instrument setting for the policy-goal variable, and (3) the reserve merely rubber-stamps the market's decision and passively implements market instructions to adjust the monetary base. The reserve interoperations are classified as:

1. Permanent Market Operations
    a. Currency exchange (FX) contracts: 'Bid', 'Ask', 'Buy', 'Sell' orders
2. Temporary Market Operations

a. Forward Contract (Spot-Forward, Forward-Forward, Original Issue Discount, Futures & Forward rate agreements): ‘Bid’, ‘Ask’, ‘Buy’, ‘Sell’, ‘Contingent’ orders
b. Contract for difference (Margin agreements): ‘Stops’, ‘Limits’, ‘Contingent’ orders

3. Settlement Operations
    a. Redeem Orders

The form and functions of the autonomous open-market reserve is detailed in the functional architecture specification section.

6. COLLABORATION IN A NETWORK

The FEWL is an ecosystem of activities required to design, produce, and provide everyday goods or services, and along which information, materials, and worth flows, and that is natively denominated in cryptocurrency. The object of this ecosystem are particularly the constraint that both the marginal rate of substitution between consumption across periods and between consumption and real balances within periods be independent of hours worked. These restrictions eliminates spillovers between the markets for goods and labour which would otherwise mean that both the supply and demand for goods would depend on conditions in the labour market.

Stylised Facts

According to the Sraffian supermultiplier model, originally presented in Serrano (1995, 1996) and further discussed and applied in Cesaratto, Serrano and Stirati (2003), output growth is shaped by the evolution of the autonomous components of demand: exports, public expenditure and credit-financed consumption.

The model has also been utilized as an interpretative tool to explain historical tendencies in output and demand for single countries (Medici, 2010; Amico et al., 2011; Freitas and Dweck, 2013).

Tested against empirical evidence for the US, France, Germany, Italy and Spain by (Daniele Girardi and Riccardo Pariboni, 2015) is that accelerations in autonomous components of aggregate demand growth tend to be followed by increases in the investment share. A one dollar increase in autonomous demand raises output by 1.6 dollars over four years.

Kevin Nell 2012 shows strong evidence of a demand-led growth transition in the Indian economy in the post-1990 liberalisation period. A combination of export growth and import substitution is arguably the most efficient way to lift a balance-of-payments constraint on demand and productivity growth. (Neill 2012) formally illustrates the saving/investment causality conditions that underlie a demand-led growth transition.

the `Disequilibrium' literature of Barro and Grossman (1971,1976), Malinvaud(1977) and Benassy (1986) imposed exogenously fixed wages and prices on small general equilibrium models, and focused on the effects of the consequent rationing of consumers or firms. A key insight was that rationing in one market was likely to affect supplies or demands in other markets because consumers and firms are linked in more than one market (i.e. the labour and goods markets).

Theoretic Analysis

Autonomous expenditure by households – rather than simply business and government – are powerfully related to individual earnings and to the distribution of income and economic development. Economic data from developing countries reveal much larger deficits in sustaining autonomous expenditures in developing countries. A change of focus to capacity-generating growth targeted at clearing autonomous-expenditure provides more opportunities to innovate the availability and directivity of resources. Once consideration is made of stabilising autonomous sectors, the variations in the amount of participatory growth rates have no discernible impact on overall economic stability. Capital formation tends to be strong and the network effect has an overall effect of stabilising balance of payments. The magnitude of change needed makes clear that closing the economic gap with developed countries will require major structural changes in finance and investment of anchor sectors.

To achieve a specification normative to the derived aggregate supply relationship of the demand-led growth model, we propose to produce and supply basic commodities capable of sufficiently meeting household's autonomous components of aggregate-expenditures while enabling their possibilities for optimal consumption/portfolio choice independently of their labour participation rate. This proposition is compatible with emerging research to stabilise human incomes through a universal basic income (so called unconditional free-money) regime, the difference being that the models approach through a universal basic work (so called unconditional free-work) regime.

Formal Description

Demand-led growth dynamics

We derive the saving/investment causality conditions that underlie a demand-led growth transition. Drawing on Thirlwall (2006).

Let (g_d), (g_w) and (g_n) be the growth rate of demand, the warranted growth rate and the maximum potential growth rate or natural growth rate respectively. And p is the growth rate of the population and proxy for the growth rate of the labour force (l): $(p \approx l)$.

$$g_{w/p} = g_w - p \; ; \; g_{d/p} = g_d - p \; and \; g_{n/p} = g_n - p$$

The warranted growth rate per person $(g_{w/p})$, is the rate that induces just enough investment demand to match planned saving. And is equal to $\frac{s}{c_r}$ where s of is the propensity to save (saving-to-income ratio) and the coefficient c_r measures the required investment to produce a unit increase of output per person at a given interest rate, i.e. $c_r = \frac{(I)}{(\Delta Y - p)}$.

Capital factor is fully employed when the growth rate of demand per person $(g_{d/p})$, is equal to the warranted growth rate per person $(g_{w/p})$; The natural growth rate per person $(g_{n/p})$ approximates labour productivity growth (q), on the assumption that the labour force participation rate remains relatively stable over time.

In the long term, the economies maximum potential growth rate is given by:

$$(g_{n/p} \approx q)$$

Labour factor is fully employed when demand per person grows at the same rate as the natural growth rate per person.

The full employment of labour and capital requires:

$$g_{d/p} = g_{w/p} = g_{n/p}$$

Sustainable Debt Dynamics

We derive a constrained growth rate consistent with a fixed deficit or debt-to-GDP ratio.

Consider the current account of a country from an initial deficit position

$$\theta(p_d + x) + (1 - \theta)(f + p_d) = p_f + m + e$$

Where in growth rates terms:

θ is the export-to-import ratio at nominal prices that measures the proportion of the import bill financed by export earnings. P_d is the domestic price of exports; X is the quantity of real exports; F is the current account deficit in real terms; FP_d is nominal capital inflows (C), to finance the deficit $(C > 0)$; P_f is the foreign price of imports; M is the quantity of real imports; and E is the nominal exchange rate measured in units of domestic currency per unit of foreign currency. Because the economy starts off from an initial current account deficit position, the export-to-import ratio is, by construction, less than one$(\theta < 1)$.

The export and import demand functions are specified as:

$$X = a\left(\frac{P_d}{P_f E}\right)^{\eta} Z^{\varepsilon}$$

Z measures world income; η is the price elasticity of demanded exports (< 0); and ε is the income elasticity of demanded exports (> 0); And

$$M = b\left(\frac{P_f E}{P_d}\right)^{\psi} Y^{\pi}$$

Y measures domestic income; ψ is the price elasticity of demanded imports (< 0); and π is the income elasticity of demanded imports (> 0).

Following McCombie and Thirlwall (1997), the sustainable debt dynamics imply a fixed debt (D)-to-GDP (Y) ratio; in growth rates terms, is $d = y$. Given this condition therefore, the growth rate of net capital inflows must be equal to the growth rate of real income: $f = y$. The constrained growth rate consistent with a fixed deficit or debt-to-GDP ratio can be written as:

$$y^* = \frac{\theta x}{\pi - (1 - \theta)}$$

Since the balance-of-payment-constrained (BPC) growth rate determines the growth rate of demand ($y^* = g_d^*$), in per capita terms is given by, where p is population growth rate:

$$g_{d/p}^* = \left(\frac{\theta x}{\pi - (1 - \theta)} - p\right)$$

With no deficit, $\theta = 1$ reduces to the simple BPC growth rule. Alternatively, with a surplus $\theta > 1$, we have the BPC growth rate consistent with a fixed surplus-to-GDP ratio.

Independent Aggregate Demand Supply Relationships

We derive an aggregate-supply model independent of the consumers problem. The

APPENDIX

[i] http://databank.worldbank.org/data/reports.aspx?source=international-comparison-program-(icp)-2011

[ii] Robert Hofmeister: Measuring the Value of Research: A Generational Accounting Approach, University of Konstanz, Germany

[iii] Selgin 1997 Less than Zero The Case for a Falling Price Level in a Growing Economy