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MONETARY AND FISCAL (SPENDING) COMPLEMENTARITIES TO ATTAIN SOCIOECONOMIC SUSTAINABILITY

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Abstract*: The paper is a study of pervasively complementary relations between money, spending, and real economy with technological change. The endogenous interrelations between these variables sustain price stability and economic growth. The usual full-employment implications of inflation and neutrality of monetary and fiscal effects on the real output in the money, spending, and real economy model that is formalized are shown to change several of the consequences of the Keynesian and monetarist model of general macroeconomic equilibrium. Instead, a Schumpeterian growth model, and financial implications of Romer's endogenous growth model stand out to be more appropriate. The conceptual model of the money, spending, and real economy endogenous relationship with technological change is rendered to empirical testing by the circular causation model, as in the case of Myrdal's cumulative causation, but with financial implications. Malaysian data are used in the estimation of the system of circular causation equations.*

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Introduction

In this paper, the topic of financial spending is studied in respect of establishing a unified inter-causal relationship of a systemic nature between money, finance, and the real economy. Such a study would also imply that there would be a closer relationship between the financial economic system and the private sector and markets. Such a result, concerning interdependency between various economic activities is explained by organic interrelations between money, finance, and the real economy. One of the ways in which the efficacy of such inter-economic interactions is evaluated is by consideration of their social wellbeing function. The term 'wellbeing' is different from the often used term of welfare function in economics. The wellbeing function evaluates and explains the degree to which there exists, or does not exist, effects of technology, innovation, and knowledge in the rest of the variables. The endogenous role of such elements is explained by their complementarities along the dynamic process of their evolution.

In the end, emergent synergistic dynamics in such a financial, economic and endogenous transformation within an inter-causal system between the variables, such as, money, spending, real economy, technology, innovation and knowledge cause government spending to be subsumed by the private sector. Otherwise, the government becomes a participant with the private sector in attaining economic goals along with social wellbeing as briefly explained above. Fiscal policy is consequently reduced while giving place to the role of private sector

spending that now arises via the participative interrelations and market transformation both between the private and public sectors and the critical socioeconomic variables mentioned above. The simulation of the wellbeing function by way of maintaining balance and complementarities between the variables and entities implies the meaning of socioeconomic sustainability.

The approach of this paper is therefore one of studying the inter-causal dynamics of the interrelations that exist and can be explained conceptually and empirically between the monetary, spending (financial), and technological choice for attaining the simulated objective of social wellbeing as defined. The wellbeing objective criterion evaluates the degree of complementarities that exists between endogenously interactive variables. The nature of such evolutionary dynamics in inter-variable and inter-causal relationships is explained by the properties of interaction, integration, and evolution along the path of socioeconomic change and sustainability. Such properties are inherent in the ensuing evolutionary learning dynamics that are explained by the imminent methodology and the model of endogenous interrelationship between money, finance, real economy, and technology.

The simulation results are conveyed or changed by the continuous sustainability of a non-inflationary regime of interrelated organic causality. This kind of a dynamic is endogenously induced by the effects of appropriate technology, which is treated in this paper as participation or complementarity as the nature of knowledge. Technology as knowledge is thus considered as an endogenous variable along with the rest of the variables.

Objective

After the introduction, this paper will first undertake a literature review of works that are used to develop the concept of endogeneity in spending and monetary aggregates while being induced by technological induction to generate a regime of expansionary economic growth within a sustainable and restrained inflationary regime. Such a financial economic regime is referred to as non-inflationary under the endogenous expansionary effect of appropriate technological change.

The underlying concepts and empirics of the inter-causal sustainability of socioeconomic change will be studied by means of a model of the unified (complementary) synergistic linkages between money (M), spending (F), and the real economy (RE) through the choice of proper financial instruments that enable such complementarities to attain and sustain. In this regard, this paper will explain how the replacement of interest rates by productive rates of return arising from the well-being goal of the real economy can augment various kinds of resources in the integrated financial economic system. The question invoked is this: How does continuous resource re-generation in the presence of productive return and the replacement of interest rates cause technological effect to come about and then develop the inter-variable synergy of relations? Here the choice of particular kinds of participative financial economic instruments plays its endogenous role in mobilizing technology in order to generate financial innovation. Institutional measures and strategies are important in this undertaking.

The second part of this paper formulates the derived model from the methodology of inter-causal and inter-variable relationship between money (M), finance (F), real economy (RE), and technology as the embodiment of knowledge. The knowledge embodiment is denoted by ‘θ’-variable. It is conceptually studied and empirically evaluated as a parameter of complementarity and therefore of social wellbeing. The emergent model is referred to as the MFRE(θ)-model system of endogenous and sustainable relations. ‘θ’ therefore denotes the level of knowledge existing in and amenable for simulation to desired levels of inter-causal

complementarities between the variables with the endogenous effect of technological change, altogether evaluated in the social wellbeing function.

Because the objective is to evaluate the intensity of the inter-variable and inter-causal complementary relations between the variables, the model derived from the methodology of continuous and sustainable complementarities (participation) as the MFRE(θ)-model is referred to as the circular causation model of such organic inter-causal relations. The nature of the complementary relations in the presence of endogenous technology effect as knowledge embodiment leads to the evaluation of the social wellbeing function. The goal is to evaluate how such endogenous participative relations between the variables generate and maintain non-inflationary economic growth and its stabilizing, predictable, and long-term sustainability.

Literature Review

The study of the emergent participative transformation of the financial economy by interaction and integration between the public and private sectors is one of unifying the role of spending and monetary forces in real sector economic change. Such a transformative system is put forward in the works of Blaug (1993, on methodology) and Soros (2000, on reversibility). Monetary, spending, and real economy inter-causal relations can also be deduced from the works of Romer in terms of the kind of financial economy that arises by way of endogenous interrelations in Romer's endogenous economic growth model (Romer, 1986). Choudhury (2013) has studied such monetary, fiscal, and real economic inter-causal relationships by means of micro-money dynamics in relation to the real economy.

Such a systemic inter-causal relationship defines the complementary dynamics between the sectors, entities, and variables in question. Its earliest trace can be read off the classical quantity theory of money (Friedman, 1889). In recent times such an investigation has re-emerged in the works of Mishkin (2007a). Despite interest in this area of redining the complementary and endogenous dynamics between the participative sectors of the financial economy, the emerging methodology has failed to formalize circular causation results. The circular causation method was earlier pronounced by Myrdal (1958) and many sociological economists. Therefore, a formal model arising from and that subsequently applies the participative endogenous methodology has not been formalized. Such an impending financial economic problem, yet crying for an academic resolution, has been clearly pointed out in *Wikipedia*:
(http://en.wikipedia.org/wiki/Interaction_between_monetary_and_fiscal_policies).

Blaug (1993) points out about the contesting views held on economic stability and economic growth by the schools of monetarism and fiscalism. Blaug (1993, p. 29) further notes such a problem in reference to macroeconomic theory: "The great debate between Keynesians and monetarists over the respective potency of spending and monetary policies has divided the economic profession, accumulating what is by now a simply enormous literature." The most significant contrast that Blaug points out is regarding the important role of knowledge in such a 'relational epistemological' debate.

On a deeper account, found in the field of heterodox economic reasoning (Lawson, 2003), the role of knowledge in the budding theory of complementarities between monetary and fiscal policies is that of epistemology. The epistemological approach to knowledge as a circular-causation variable embedded in technological change generates the complementary relationship, between money and spending beyond fiscal taking off, that arises from its endogenous dynamics in the MFRE(θ)-model. This determining factor of knowledge is

manifested in the inter-causal and inter-variable relations of complementarities in the wellbeing function of the MFRE(θ)-model.

We will refer to the above-mentioned nature of knowledge embodied in the endogenous nature of technology interacting with the other variables as 'relational epistemology' by virtue of its evolutionary learning role in the cause-effect interchangeable relations across the continuous sustainability regime of non-inflationary economic growth and development under the effect of endogenous technology. In the endogenous 'relational epistemological' sense (Campbell, 1988) the economy is studied in reference to a circular causation *system* of *inter*relations between the defining variables of the wellbeing objective criterion. The imminent theme of inter-causality explained by the simulation of the wellbeing objective criterion, subject to circular causation interrelations between the variables of an interactive and integrative financial economy is strongly pointed out by Blaug (1993, pp. 221): "Monetarism never succeeded in clarifying the causal mechanism that produced its empirical results, sometimes even denying that these results required interpretation in the light of a supporting causal theory, and it failed to refute any but a crude travesty of the Keynesian theory it opposed. Keynesianism on the other hand, proved to be capable of absorbing monetarist ideas in a more sophisticated brand of macroeconomics that appears to be emerging from the fifteen-year-old melee."

In the circular causation model of the simulation of the wellbeing criterion linked with MFRE(θ), an example of the socially embedded economic system arises. Social embedding is a vastly complex study in system dynamics. Social complexity by the system dynamics can be studied by the application of works of Bartalanffy (1974); Skyttner (2005); and Maturana and Varela (1987).

The end result of such interactive system study of the financial economy of MFRE(θ) is shown in terms of the fields of randomness, perturbations, volatility and uncertainty that are the macroeconomic results in monetary and spending dynamics using the aggregate demand and aggregate supply analysis of general equilibrium. Thereby, a well-determined means for prediction and forecasting becomes evasive in the face of the ensuing uncertainty and randomness (Choudhury, 2013). The resolution of economic stabilization in an extended field of technologically induced economic growth and development is lost. On the other hand, measured complexity in the field of inter-causality of the circular causation system of equations can be made to replace the anomie of randomness and perturbations of the otherwise uncontrollable complexity by the property of endogeneity.

The interrelations in such a complementary concept of circular causation invoke the principle of cumulative causation that was conceptualized by Myrdal (1958). On the same topic, Toner (1999a, p. 124) unbares the theory of circular causation in respect of the endogenous interrelations between the economic and non-economic (social) elements for a comprehensive understanding of economic theory in explaining the idea of social wellbeing: "The notion of complementarity in production and consumption is central to CC (circular causation in the theory of cumulative causation). For Kaldor, given his concern with growth and dynamics as opposed to the allocation of fixed resources, complementarity in production and consumption is far more pervasive and significant than the neoclassical principle of substitution." The same kind of strong circular causation between economic and non-economic complementarities is upheld by Kaldor (1975).

The importance of studying the inter-causality between parametric and non-parametric variables is inescapable in policy and institutional analysis. Lucas (1975) had such a comprehensive social perspective in his theory of rational expectations, yet the Markovian adaptive nature of information flow in the monetary model in the name of creating a simplicity of solution, collapses into the simplified preference nature of steady-state

equilibrium. The result then is to constrain the degree of real complexity in Lucas' model (Minford & Peel, 1983).

As an example, the attenuating monetary model treats adaptation of the information sub-model as an exogenous happening in the monetary model. This kind of approach does away with the continuous endogeneity by inter-causality between knowledge and the monetary system, as otherwise required to explain complex complementary interrelations. The exemplar case is of our MFRE(θ)-model. Now, recourse to the study of exogenously determined equilibrium in Lucas model replaces the endogenous dynamics of evolutionary equilibriums. The latter case is formalized in the complex systemic 'relational epistemological' model by Shakun (1988).

In the MFRE(θ)-model, the nature of complexity and perturbations leads into the study of evolutionary equilibrium. Consequently, in the traditional case of monetary and spending debate, the goal of full-employment and the nature of the analysis centered in aggregate demand, aggregate supply, and IS and LM curves, have continued on. The possibility of studying endogenous effects has remained foreign to the development of a robust model of monetary and spending complementarities with sustained stabilization under appropriate technological effect.

Certain kinds of endogenous inter-causal relationship between money and spending were studied in the extended form of the quantity theory equation of exchange (Friedman, 1989, 1960). Mishkin (2007a) writes importantly on this issue. Mishkin's theory offers weak treatment of the above-mentioned problem caused by non-complementarities between monetary and spending dynamics, however. Only the time-dynamics, as opposed to the knowledge-dynamics over time, is maintained. Yet it is true that the policy futures are deeply discursive in nature. This marks the role of epistemology in conceptual and applied perspectives of money and spending complementary dynamics in respect of the real economy, technology and their many inherent variables.

The result ensuing from Mishkin's monetary policy strategy on non-inflationary economic expansion is also one that we examine in relation to spending policies and their alignment with the real economy and the role of technology as an embodiment of knowledge in the resulting inter-causal relations. The central bank should have independence in setting its monetary goals and development of financial instruments for sustainable money and spending relations in an environment of technological change and the continuity of resource generation and its mobilization into the productive real economy.

In regards to the spending role in its monetary complementarities, Mishkin writes (op cit, p. 41): "Price stability should be the overriding, long-run goal of monetary policy". In this p, we model this possibility by developing the technological dynamics in complementing money and spending with the technologically induced real economy of the type of MFRE(θ)-model. Such arguments point in the direction of the birth of post-monetarist economics that will be complementary to the spending economics, as of Keynes. They also explain the complementarities at the institutional levels involving the private and public sectors, markets and economy.

The question remains: Why is the complementary nature of money and spending in real economic expansion desired? An answer to this question is this: Monetary policy focuses on private and market-oriented developments. On the other side, government management of spending is necessary for investment and social objectives to correct market failures. Indeed, such was Keynes' original motivation when he was driven by implicating G.E. Moore's ethical views of economic stabilization with government social expenditure for attaining non-inflationary macroeconomic stabilization.

Mishkin (2007b, p. 59-73) points out a further issue: That is the topic of the combined effect of money (M) and spending regimes and policies (f) on asset prices (P). In this paper, we left spending to be proxied by investment (I). Let the growth of real assets be denoted by the net worth of firms, NW. Let the cost of capital be denoted by 'c'. Let the rate of interest be denoted by 'r'. The market deepening transformation shown by increasing real output, Y, requires unleasing and continuous regenerating of resources. Thereby, both 'c' and 'r' must decline to mobilize resources. Consequently, we have a chain of inter-causal relations between the variables of MFRE: $M\uparrow \Rightarrow c\downarrow \Rightarrow r\downarrow \Rightarrow P\uparrow \Rightarrow I\uparrow \Rightarrow NW\uparrow \Rightarrow Y\uparrow$.

Such a relationship has an important bearing on our formulation of the MFRE(θ)-model. It explains that a quantity of money M is complemented with spending, 'I'. The net result is the valuation of economic performance measured by NW and Y. Such inter-variable causality is enhanced by declining 'c' and 'r', and with 'P' increasing takes place via the productivity effects of I and NW on Y.

Theoretical Discussion

In the MFRE(θ)-model of money, spending, and the real economy, we will show how such a model establishes linkages between these sectors. We consider the phasing out of interest rates (r) and cost of capital (c), while prices remain stable in an expanding economy. All of these are reflected in the growth rate of Y, remaining higher than the rate of change of P, and being minimally equal to the rate of increase in the quantity of money. In other words, the real output, real money, and real spending, increase together.

The above kind of ideas relating to the endogenous interrelationship between money and spending, taken on the production side, is inherent in the theory of post-Keynesian economics. Arestis (1992, p. 109)) writes on this issue in respect of the post-Keynesian nature of monetary and spending interrelationship: "Money is viewed as essentially endogenous in a credit money economy. Its behaviour is governed by the portfolio needs of firms, persons, governments and financial institutions."

An example explaining the organic interrelationship in MFRE(θ)

For instance, the income multiplier effect of both fiscal (spending) and monetary liberalization near to the vicinity of the full-employment point of output in a Keynesian general equilibrium system of MFRE relationship causes inflationary pressure, and the monetary and fiscal effects are sterlized. Monetarists argue that every dollar of fiscal expansion causes an inflationary effect. Thereby, the full-employment point of general equilibrium becomes evasive.

Along the Keynesian aggregate supply curve and the monetarist classical aggregate supply curve, the neutrality of monetary and fiscal policies to output causes the inflationary pressure. The question then is whether fiscal expansion replaced by spending, causes stabilizing effects in such a case of monetary and fiscal (spending) impacts on the macroeconomic general equilibrium model. The monetarists and Keynesians have always opposed each other on the matter of attaining sustainable stabilization with the joint effects of expansionary monetary and fiscal policies.

In this paper we argue that complementarities between monetary and fiscal policies can be attainable in the transformative regime of spending in the real economy with endogenous *inter*relationships. Such endogenous effects are generated by appropriate technology in engendering long-run stable and non-inflationary economic expansion. These conditions

attenuate to social wellbeing. The attainment of MFRE(θ) complementarities in the stable and sustainable forms also unleashes sustainable consequences of the monetary and spending regimes on other critical variables of the money and spending functions. Among such variables are employment, real income and entitlements, real profitability, financial stability, and more.

Price stability along with the growth of output in the complementary monetary and spending regimes therefore involves endogenous, that is, knowledge-induced evolutionary learning, as of technological induction to generate inter-variable causality. The result is the generation of complementary relations between the representative variables underlying the monetary and spending functions. In such inter-causal participative relationships between the variables, financial innovation underlying appropriate technological choice is affected by replacing interest rates with productive financial instruments.

The systemic study of complementary interrelations in the circular causation system simulates the social wellbeing objective function of a sustainable economy involving the social order. The formalism is explained by the MFRE(θ)-participative relations. In the end, the theme of monetary, spending, and real economy complementarities encompasses a broader perspective. This is that of simulating the complementary relations in the circular causation system of the critical variables. The objective of the evaluation of the social wellbeing is realized.

Systemic treatment of MFRE(θ)

A system is defined here by the inter-causal nature of endogenously interrelating variables under the effect of knowledge induction. In the MFRE(θ)-model, the system of inter-variable and inter-causal relations are brought together for evaluation of their complementarities, or lack of it, by using the social wellbeing function. By the inherent system of inter-causal equations between the variables, empirical evaluation of the social wellbeing function is carried out subject to the system of circular causation relations.

Estimation evaluates the degree of prevailing inter-variable complementarities in the 'as is' state of the financial economy. Simulation gives the way of generating the 'as it ought to be' state of the complementary relationships between the variables. The vector of variables selected is {y,M,f,P,ρ}[θ]; ρ denotes the technology variable. Each of the variables of this vector is induced by the knowledge-flow, θ-variable. 'θ'-values are calculated in light of the desired level of inter-variable complementarities.

Ordinal values are assigned to the θ-variable in the light of its prorated values of economic and financial performance. An average is then taken across the ordinal assignments of θ-values in respect of given observations in data in order to obtain the final θ-values as ranked values. In this way, the θ-values form a set of data aligning with the MFRE(θ) observations.

The entire data of observations including the generated θ-values now comprise the full data set required for the assessment of the evaluation model comprising the social wellbeing and its circular causation equations. The existing state and the simulated reconstruction for complementarities between the MFRE(θ)-data are explained by the numerical signs of the estimated and simulated coefficients of money, spending, and real economy interrelations with the endogenous effects of technology. Their degrees of complementarities are explained by the coefficients of the social wellbeing function.

The social wellbeing criterion in its measurable form indicates the degrees of complementarities that exist or can be alternatively simulated in the state of inter-variable complementarities as these 'ought to be'. The empirical form of the social wellbeing function

now coincides with the monotone of θ-function in the vector of variables. We denote it by, $\theta = F(y,M,f,P,\rho)$. The system of circular causation relations between the variables of the social wellbeing function is denoted by, $x_i(\theta) = F_i(\mathbf{z/x})[\theta]$. 'i' denotes the specific variable of the vector of **x**-variables in the vector $\{y,M,f,P,\rho\}[\theta]$. **'z/x'** denotes the vector without the particular 'dependent' x-variable in the particular list of structural regression equations. The totality of all such equations forms the circular causation system of structural regression equations. All variables of the structural equations are driven by the normative outlook of the potentially complementary systems of inter-causal and inter-variable relationships.

In a more detailed form of circular causation system, specifically that of structural equations for the case of endogenous inter-causality between money, spending, real economy, technology, instruments and policies, we have the following specific relations:

$$M = F_m(y,f,P,\rho)[\theta]; \quad (1)$$

$$f = F_f(y,M,P,\rho)[\theta]. \quad (2)$$

The consequential price and output variables to determine the degree of stability with economic growth in the system are as follows:

$$P = F_P(y,M,f,\rho)[\theta]; \quad (3)$$

$$y = F_y(M,f,P,\rho)[\theta]. \quad (4)$$

The productivity relation, synonymously the technology relationship, is given by

$$\rho = F_\rho(y,M,f,P)[\theta]. \quad (5)$$

Thus all the equations are firstly 'estimated'. The estimated coefficients denote the respective levels of complementarities between the endogenously interrelated variables. Good degrees of complementarities are signs of the effectiveness of the interrelationships between the variables, and in thereby evaluating the social wellbeing function to design the pattern of socioeconomic sustainability.

Thus in the empirical exercise, the estimated ('as is' state of the financial economy) relations are normatively ('as it ought to be' state of the financial economy) simulated by affecting changes in the estimated coefficients. The Austrian School of Economics is known to have used such an approach (von Mises, 1976). Yeager (1997) referred to endogenous money in the relational sense of interaction and evolution occurring by a *laissez faire* concept of money.

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Formulating the Money, Finance (Spending) and Real Economy MFRE(θ)-Model

By taking stock of the above-mentioned explanation we can formulate the complete MFRE(θ)-model as follows:

'Evaluate' wellbeing function, $W = W(y,M,f,P,E,\rho)\ [\theta]$ (6)

The social wellbeing function is evaluated subject to the estimation of circular causation relations between the variables. Secondly, reconstructed states governing the simulation of complementary relations are generated between $\{y,M,f,P,E,\rho\}[\theta]$ by appropriately changing the estimated coefficients. Additionally to the former vector of variables, the variable E denotes employment, which can be alternatively expressed as employment rate (oppositely unemployment rate).

The circular causation equations between the variables of the vector $\{y,M,f,P,E,\rho\}[\theta]$ can be constructed, as pointed out in the previous section. The circular causation relationships would imply either the existence of, or the normative reconstructive possibility for, inter-variable complementarities. Thus, estimation is followed by simulation. The simulated coefficients can be very many, reflecting the simulacra nature of the inherent evolutionary learning system. Consequently, in the emergent multiple simulation possibility as realized by various reconstructions of the coefficients, signifying degrees of complementarities between the inter-causal variables, learning coefficients arise. Such a course of economic transformation defines the inherent interactive, integrative, and evolutionary learning properties of the simulacra.

In the MFRE(θ)-model, the normative picture is that the quantity of money is made to connect with real economic activities via suitable productivity-based financial instruments marking financial innovation in spending. The spending activity takes place in the real economy to support productivity related activities with technological change. The absence or reduction of interest rates (r) and cost of capital (c) causes the mobilization of money into real economic activities via spending in productive activities such as investment. Thereby, ρ increases as long as technological advances and endogenous circular causation relations between the variables realize increasing returns to scale (Toner, 1999b). These kinds of inter-variable effects mean that, as the technology variable ρ increases, increasing returns and complementarities between monetary and spending regimes cause prices to increase but at rates lower than the rate of real output. The result is a regime of stable prices.

The series of circular causation effects between the variables of MFRE(θ)-model can now be explained. The effect of technological advancement on the monetary regime is indicated by the shifting macroeconomic LM-curve. The macroeconomic IS-curve presents the spending regime.

With the simultaneous increase in LM and IS curves as interest rates and the cost of capital decline, the elasticity coefficient, $[(1/P)*(dP/dt)]/[(1/y)*(dy/dt)] = \varepsilon_{p,y}$ remains stable under the impact of endogenous technological change. The result of such price and output movements in the end is price stability. Real output is inter-causally sustained with technological change.

Likewise, technological change is sustained endogenously by an evolutionary learning process as interactions proceed between all variables. Yet again, the positive coefficients of 'ρ' will have positive effects on the other predictors, and so on in the circular interrelations between the variables.

The expectation regarding the signs of the estimated coefficients is, though, not guaranteed. The positivistic nature of data could prove otherwise. For instance, it is possible that interest rates and the cost of capital do not decline; yet the price level remains stable by the action of higher interest rate policy. It is also possible in this case for the financial sector to grow in opposition to the real sector. Consequently, output would grow under the force of financial expansion.

Yet at the end, the social wellbeing will be adversely affected; for endogenous technological change would fail to exist in order to complement increasing levels of employment and price stability. The objectives of the MFRE(θ)-model will be lost by the loss of complementarities between the sectors. The IS and LM curves will halt to shift. The Keynesian-Friedman monetary, fiscal, and full-employment general equilibrium analysis will reappear. The social wellbeing and stability that would be generated by complementarities in MFRE(θ)-model is lost.

The real economic sector and the financial sector will fail to complement each other as resources move away from the real sector into the financial sector in the form of bank-savings. Bank-savings as financial resource withheld become time-wise withdrawals from the real economy, and hence impede productivity gains at all points of time. This is shown both by the Keynesian type comparative statics and in the inter-temporal case. The role of knowledge dynamics in the generalized system of complementarities that need to be formed by endogenous circular causation relations between wellbeing-inducing possibilities, fades away.

Under such adverse conditions, the positivistic estimated results of circular causation equations and the measured social wellbeing index need to be 'simulated' by improving the unwanted signs and values of the coefficients. The further result that arises from these kinds of inter-variable circular causation relationships is that there is no constrained or unsustainable notion of full-employment level of output in the case of technologically induced consequences on price and output stability caused by complementarities between monetary and spending regimes.

Simulation for generating complementarities by improving the signs of the coefficient between the variables can be targeted for the following kinds of relations:

$$[M\uparrow \Rightarrow f\uparrow \Rightarrow r\downarrow \Rightarrow c\downarrow \Rightarrow (P\hat{} \rightarrow 0) \Rightarrow y\uparrow \Rightarrow E\uparrow \Rightarrow \rho\uparrow](\theta), \qquad (8)$$

P^ denotes rate of change in price level; (P^→0) denotes attainment of price stability. The chain (8) of interrelations influenced by the impact of evolutionary learning (simulacra), 'θ' in the circular causation variables, is similar to that given by Mishkin in respect of real asset valuation. In the MFRE(θ) interrelations, the critical levels of complementarities to study are those between the monetary regime characterized by {M,R}[θ]; the spending regime f(r)[θ]; and the real economy {y,E,P^,R,ρ}[θ]. 'R' denotes the rate of return on real assets.

These MFRE[θ]-relations explain that, increasing 'R' and 'P' levels replace interest rates and cost of capital with the relationship between inflation and money, spending, and real economy circular effects (Benanke & Mishkin, 2007). That is, a certain price target is set. Inflation gravitates towards this target and spells out the monetary policies needed to maintain the inflation target. Now the Central Bank becomes a joint venturist with the private sector (commercial banks) in order to promote market deepening and widening. Prices are stabilized under the impact of such, resulting in the consequences of endogenous change with technology and the continuous evolutionary learning behaviour of the representative variables.

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Explaining the Endogenous Relationship between Technological Change and Economic Growth in the MFRE(θ)-Model

Endogeneity is signified by the circular causation relationship between the variables of the MFRE(θ)-model. Such interrelations are simulated out of estimations made concerning the circular causation relationships by the representation of 'θ'-values signifying the knowledge-induced impact of technology in the wellbeing function of the MFRE(θ)-model.

The expansion of technology is like the expansion of knowledge and information in the system of circular causation relations. What emerges is a learning system of evolutionary interrelations between the critical variables. The integrated MFRE(θ) system induced by knowledge and its induction of technological choices invokes the study of sustainability in endogenous growth and development models.

Myrdal (1957), who we have referred to earlier, (see Toner, 1997c), Schumpeter (see Cantner et al 2009) and the Austrian School of Economics (Kirzner, 1997), and in respect of the moral economy by Boulding (1971, 1981), and recently the new (endogenous) growth theory of Romer (1986) have left a legacy in the development of evolutionary socioeconomic growth and development paradigms. This paper follows the same lines. There is a difference though, in the methodology.

The evolutionary learning model of endogenous complementarities via circular causation relations in this paper shares with, but yet differs from, the genre of models in the Austrian vintage, specifically with Schumpeter's model of development with creative destruction. The major difference is on the issue of the continuity of technological enhancement in the evolutionary model of circular causation. Opposed to this is Schumpeter's discontinuity property in the growth of spending (investment), and the need for a monopoly to pick up the slack caused by such temporary slowdown. On this issue Gaffard (2009) writes: "As shown with the model used by means of numerical simulations, the introduction of the new technology generates an initial fluctuation, which brings about temporary unemployment as well as a temporary fall in productivity. However, this fluctuation very soon dampens down and the economy converges to a new steady-state corresponding to the superior technology, with a higher level of productivity—which allows lower prices and higher real wages—and full employment". This problem of a temporary halt in economic expansion, subsequently causing disequilibrium in the Schumpeterian perspective of economic growth and development, is overcome in the MFRE(θ)-model by the continuous simulation of the social wellbeing function with circular causation relations relating to the inherent properties of interaction, integration, and evolutionary learning. These attributes, together, represent the dynamics of knowledge-induced change.

The MFRE(θ) represents the continuous transformation that carries with it a knowledge-induced dynamic life-sustaining 'needs'-oriented socioeconomic change. Corresponding to such transformation is the dynamic 'needs' regime of development, and the endogenous nature of money as the value of spending1 in the real economy. The choice of technology and

1 Quantity of Money = Total Spending by the equation of exchange with a subtle meaning: MV=Py. This implies that a portion of the total quantity of money denoted by MV equals the value of its expenditure in transactions on real things denoted by Py = nominal value of output. However, if we further assume that direction of money is into projects appearing in various interlinked sectors (say, i = 1,2,…,n) then, a micro-quantity of money (say M_i) flows fully to equate to the spending (P_iy_i) requirements of that project. Thereby, $M_i=P_iy_i$. In this case $V_i = 1$ because a quantity of micro-money flows fully into specific projects.

Furthermore, because of the interlinked nature of the sectoral projects, total quantity of money arising from the micro-foundations is equal to $M = [\sqrt[n]{\prod M_i}] = [\sqrt[n]{\prod P_iy_i}] = [\sqrt[n]{\prod P_i}]*[\sqrt[n]{\prod y_i}] = P*y$. This expression is

the corresponding participative financial instruments help in complementing the monetary, spending, and real economy activities. Such inter-sectoral relational dynamics present the sign of systemic learning, and also the knowledge-induced dynamics of the MFRE(θ)-model.

The continuously integrated transformation in the MFRE(θ)-model interacts with the old and failing industries to transform them by organic participation and complementarities of the old and new. Thereby, the MFRE(θ)-model causes nascent industry protection and establishes such a complementary scenario through its important properties of interaction, integration, and evolutionary learning between the representative variables.

Such a feature is not found in the Schumpeterian growth model. Schumpeter writes on the marginal substitution nature of the growth model: "There is certainly no point in trying to conserve obsolescent industries indefinitely; but there is a point in trying to avoid their coming down with a crash and in attempting to turn a rout, which may become a center of cumulative depressive effects, into orderly retreat". Thus there are both similarities and dissimilarities between the MFRE(θ)-model and Schumpeterian development dynamics.

The consequence of the endogenous relationship between technology and the evolutionary learning economy of the MFRE(θ)-model, is that while this realizes non-inflationary growth, it also leads into the simulated attainment of social wellbeing by desired changes in the coefficients to improve the complementarity situation between the estimated variables. Monetary and spending activities feed into the social wellbeing and stabilization consequences in the real economy. On this matter as well, there is similarity between MFRE(θ)-model and Schumpeterian growth model. Gaffard (2009) writes in this regard: "Active monetary and banking policies allow productivity gains associated with the introduction of a new and superior technology to be captured. As Schumpeter pointed out, money forces the economic system into new channels and allows a quasi-steady state to be re-established."

The MFRE(θ)-model by virtue of its evolutionary learning and the nature of the interactive and integrative relationship between the inherent variables, causes perturbations around the points of evolutionary equilibriums. Such interrelations are analytically explained by the circular causation system of equations with its evolutionary equilibrium relations between the selected variables. It is therefore possible that the evolutionary perspectives of MFRE(θ) and the Schumpeterian growth model can converge in the state of a *dynamic* basic-needs regime of development, which could be caused by the appropriate nature of technological change and innovation as Schumpeter envisioned. Gafford (2009) points this out: "Schumpeter addresses the question of the intensity and the speed of structural changes and pleads for gradualism."

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more appropriate than the simple case of disjoint projects, thereby disjoint sectors that are spanned by such projects. In that case total quantity of money circulating in given independently distributed projects would be the uninteresting case, $M = \Sigma_{i=1}^{n} M_i = \Sigma_{i=1}^{n} P_i * y_i$.

The micro-foundations of the quantity theory of money expressed in terms of the disaggregate forms of the equation of exchange implies direct complementarities between money and spending with the real economy. In such a structure of the economy there is no role for rates of interest and the cost of capital. These are replaced by real yields, rates of returns, profit rates and profit-sharing rate in the project-specific case.

Empirics

A statistical example of estimation and simulation of circular causation relations in money, finance, and real economy relations -- the case of Malaysia (Choudhury, M.A., Halid, N., Ahmed, M.S., Hossain, M.S. (2013))

The theory and formalism presented in this paper by the complementary relations of the MFRE(θ)-model and its inherent circular causation relations are now empirically tested to provide an example. The application is simplified to a vector of few variables and thereby a number of equations. The method of sequencing the 'estimation' and 'simulation' is shown in order to bring out the financial and economic implications of the statistical results in these two cases. Statistical work is carried out by estimation with ordinary least square regression of the multiple structural equations of circular causation. Simulation of selected coefficients to improve the degree of complementarities between the corresponding variables is done by applying the Spatial Domain Analysis of Geographical Information Systems. The SDA method is innovated to the case of financial and economic application and thereby to the simulation of the wellbeing function as the indicator of ethical reconstruction as the function of the socioeconomic embedding of the financial and economic variables. In carrying out the simulation too, we have only one case so as to set the application in the proper perspective.

The following statistical exercise and SDA (GIS) brings forth some of the characteristics of the MFRE(θ)-model in respect of money, spending, and real economy circular causation relations with 'θ' denoting the measured parameter of degrees of complementarities between the variables of the wellbeing function.

The circular causation relations between the following variables are studied:

M denotes quantity of money in circulation.

IN denotes the volume of investment, which is now treated as the spending variable.

TRADE denotes the total trade as shown.

θ denotes ordinal values proportionate to the averaged degrees of complementarities between the individual variables after ranking θ-values by their individual columns of socioeconomic variables.

Estimated equations

$$\ln\theta = -0.514 + 0.792 \ln M - 0.244 \ln IN + 0.123 \ln TRADE \quad (9)$$

SE = 0.0348958 R-Sq = 97.2% R-Sq(adj) = 96.6%

Durbin-Watson statistic = 1.87454

$$\ln TRADE = 6.53 - 1.63 \ln M - 0.022 \ln IN + 1.57 \ln\theta \quad (10)$$

SE = 0.124388 R-Sq = 87.1% R-Sq(adj) = 84.5%

Durbin-Watson statistic = 0.887537

$$\ln M = 1.20 + 0.244 \ln IN - 0.176 \ln TRADE + 1.09 \ln\theta \quad (11)$$

SE = 0.0408542 R-Sq = 88.1% R-Sq(adj) = 85.8%

Durbin-Watson statistic = 1.57629

$\ln IN = 1.32 + 2.27 \ln M - 0.022 \ln TRADE - 3.11 \ln \theta$ (12)

SE = 0.124582 R-Sq = 96.0% R-Sq(adj) = 95.1%

Durbin-Watson statistic = 1.45823

Simulated equations (using the SDA numerical choices for selected coefficients)

The simulated coefficients are selected to replace some of the lower complementary coefficients of the estimated equations. Such simulation coefficients are selected out of the very large number of possibilities that are generated by the SDA tables next to the graphical representations (Figure 1). These tables point out the degrees of complementarities between the specific variables by the variations of colors. The deeper colors imply stronger complementarities. The very large number of coefficient values generated implies the possibility of simulacra by using the circular causation results over evolutionary learning processes, as well as intra-processes.

We note that only equation (10) needs to be simulated for our study. The other equations are not simulated as the coefficients are acceptable in establishing near possible complementarities between the variables as shown, though such a state is not perfect between TRADE and IN, and vice versa.

$\ln TRADE = 6.53 - 1.417.\ln M - 0.022 \ln IN + 1.57 \ln \theta$ (13)

Discussion of Results

Statistical results combined with SDA results2

In equation (13) the change of coefficient to -1.417 denotes a (%change in TRADE)/(%change in M). The value is selected from the computer generated table by the side of the SDA Figure 1. This means that a 1% increase in M decreases Trade by 1.417 of 1 percent. Likewise a 1 percent increase in TRADE decreases M by 0.176 of 1 percent; and a 1 percent increase in TRADE decreases IN by 0.022 of 1 per cent. Otherwise, money circulation (M) and investment as spending (IN) are complementary.

The quantitative form of the wellbeing function has complementarities with M and TRADE but not with IN. Yet the sum of the estimated coefficients of the variables as their elasticity coefficients in respect of 'θ' (quantitative wellbeing) equals 1.154. This implies that economy of scale exists in the wellbeing function. Socioeconomic sustainability is thus attainable.

2 Spatial Domain Analysis (SDA) is a methodology within Geographical Information System (GIS) that maps the interrelations between variables (hence entities), which can be represented in the real space. But when we treat the socioeconomic and abstract socio-scientific cases by means of SDA, we take the real space to be represented by measured variables. Such measurements can be actual data or ordinalized representations.

An explanation to the above statistical results can be given. There is some diversion of resources away from TRADE and into monetary and financial complementarity, but this is at a small cost to the real economy, which can be represented by the TRADE variable. The marginal rate of substitution, a neoclassical economic concept contrary to the sustainability principle of complementarity, is small. This marginal rate of substitution equals 1.63 of 1 per cent change between TRADE and M (simulated to 1.417); and is 0.022 of 1 per cent change as the marginal rate of substitution between TRADE and IN.

There are still a few other points of inference to note in the empirical results: Firstly, the selection of simulated coefficients depends upon an expert group and institutional discussions. There are policies, strategies, and possibilities relating to resource availability at any point in time to be considered in setting the simulated values. Secondly, evolutionary learning being inherent in the circular causation model as of MFRE(θ) with θ-effect over subsequent evolutionary learning processes, the new choices of θ-values implies the existence of simulacra of such choices of coefficients as needed. Thirdly we note that, even within the limits of the one-process study, in the circular causation form of the MFRE(θ)-model, socioeconomic sustainability of the Malaysian economy is attainable through the result of the wellbeing function, subject to further improvement along the evolutionary learning experience beyond the time-period of study, 1990-2008.

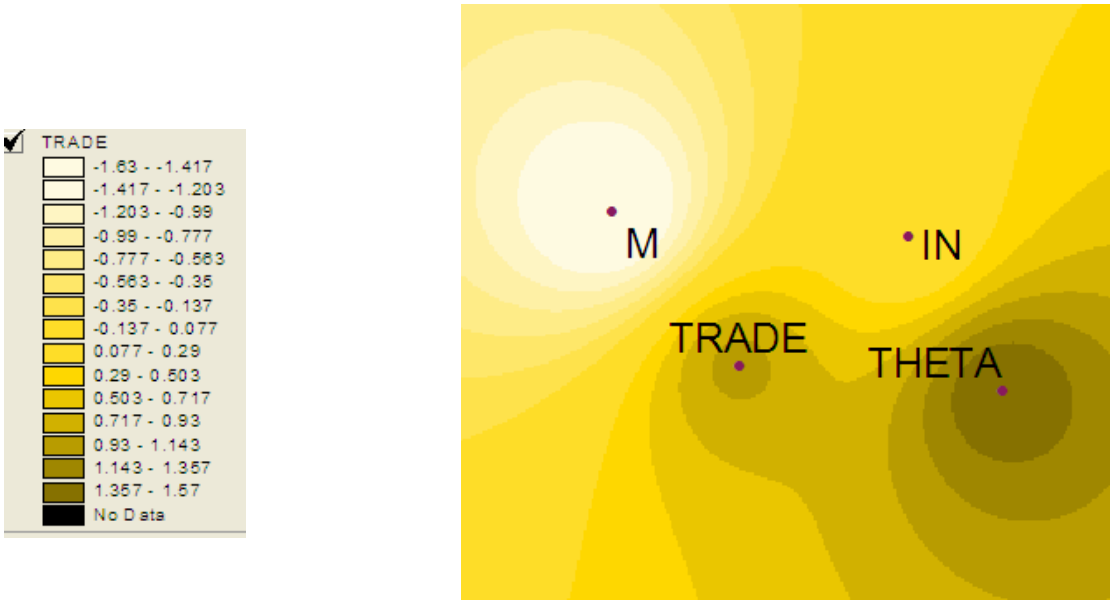

Figure 1: SDA Analysis InTRADE versus InM, InIN, Inθ

$$\ln TRADE = 6.53 - 1.63 \ln M - 0.022 \ln IN + 1.57 \ln \theta$$

simulated coefficient value (-1.417)

Conclusion

The principal contribution of this paper was in formalizing an endogenous inter-causal organic relational model between money, finance, and real economic variables along with their other explanatory variables. We called this system of inter-variable causal relations the circular causation between money, finance, and real economy, as realized by means of the catalytic effects of technology, innovation, and, most importantly, of the role of epistemological knowledge induced in all of these inter-causal variables. As a result of such an epistemological implication, there ought to exist pervasive complementarities between the variables of socioeconomic sustainability. The net result of such complementary relations is a regime of stabilization with economic expansion for the purpose of attaining the social wellbeing function. The complementarity between monetary and spending regimes in the real economy with the technological effect of knowledge induction in sustainability was a matter recognized by Blaug. He writes on this point (1993, p. 216): "The great debate between Keynesian and monetarists over the respective potency of spending and monetary policy had divided the economic profession, accumulating what is by now a simply enormous literature."

Blaug continues on (p. 221): "…. monetarism never succeeded in clarifying the causal mechanism that produced its empirical results, sometimes even denying that these results required interpretation in the light of a supporting causal theory, and it failed to refute any but a crude travesty of the Keynesian theory it opposed. … Keynesianism on the other hand, proved to be capable of absorbing monetarist ideas in a core sophisticated brand of macroeconomics that appears to be emerging from the fifteen-year-old melee." As a result, the emergence of a theory of macroeconomic policy coordination, politico-economic institutionalism, economic stabilization, and sustainability has remained questionable to date.

A divide has existed between the deductive and inductive reasoning in monetary and spending regimes of the macroeconomic stabilization and non-inflationary growth. The corresponding model was dealt with by Popper and Samuelson (Boland, 1989). On the other hand, the forces embedded in the endogenous nature of ethics in economic modeling at the most rigorous level and depth of intellection is studied by Sen (1990). Such an ethical meaning is implied by the complementarities between deductive and inductive reasoning. Such socioeconomic issues can be normatively and empirically studied in relation to the state of complementary relations between monetary and spending regimes in the real economy. This paper has undertaken a conceptual and illustrative empirical study to establish the research problem of the inter-variable complementarities in the constructed MFRE(θ)-model.

References

Arestis, P. (1992). "Post-Keynesian economics", in his *The Post-Keynesian Approach to Economics*, pp, 109, Hants, Eng: Edward Elgar Publishing Ltd.

Benanke, B., & Mishkin, F.S. (2007). "Inflation targeting: a new framework for monetary policy", in Mishkin, F.S. *Monetary Policy Strategy*, pp. 207-226, Cambridge, MA: The MIT Press.

Blaug, M, (1993). *The Methodology of Economics*, Cambridge, Eng: Cambridge University Press

Boland, L.A. (1989). "On the methodology of economic model building", in his *The Methodology of Economic Model Building*, pp. 39-63, London, Eng: Routledge.

Boulding, K. E. (1971). "Economics as a moral science", in Globe, F.R. (ed.) *Boulding Collected Papers Vol. 2*, Boulder, CO: Association of University Press.

Boulding, K.E. (1981). *Evolutionary Economics*, New York: Russell Sage.

Campbell, D.T. (1988). "Evolutionary epistemology", in G. Radnitzky & W.W. Bartley III (eds.), *Evolutionary Epistemology, Rationality, and the Sociology of Knowledge*, pp. 47-89, La Salle, IL: Open Court.

Cantner, U., Luc Gaffard, J., & Nesta, L. (eds.) (2009). *Schumpeterian Perspectives on Innovation, Competition, and Growth*. New York, NY: Springer.

Choudhury, M.A. (2011a). *Islamic Economics and Finance: an Epistemological Inquiry*, Bingley, UK: Emerald.

Choudhury, M.A., & Ahmed, M.S. (2013). "Perturbation theory in cognitive socio-scientific research: towards sociological economic analysis", *Mind & Society*, 12:2, pp. 203-217

Choudhury, M.A., Halid, N., Ahmed, M.S., Hossain, M.S. (2013). "Fiscalism as spending and monetary integration", *International Journal of Management Studies*, 20:1, pp. 1-39.

Choudhury, Mufeedh.U.A. (2009). *Money, Finance, and the Real Economy in Islamic Banking and Finance: Perspectives from the Maqasid as-Shari'ah*, unpublished MSC dissertation, Department of Economics, University of Stirling, UK.

Friedman, M. (1960). *A Program for Monetary Stability*, New York, NY: Fordham University Press.

Friedman, M. (1989). "Quantity Theory of Money", *New Palgrave: Money*, op cit. pp. 1-40.

Gafford, J. (2009). "Innovation, competition, and growth: Schumpeterian ideas within a Hicksian framework", in Cantner, U. Luc Gaffard, J., & Nesta, L. (eds.), *Schumpeterian Perspectives on Innovation, Competition, and Growth*, pp. 7-24, New York, NY: Springer.

Kaldor, N. (1975). "What is wrong with economic theory?" *Quarterly Journal of Economics*, LXXXIX:3, pp. 347-357.

Kirzner, I. (1997). "Entrepreneurial discovery and the competitive market process: an Austrian approach", *Journal of Economic Literature*, XXXV:1, pp. 60-85.

Lawson, T. (2003). "An evolutionary economics?" in his *Reorienting Economics*, pp. 110-140, London, Eng: Routledge.

Lucas, R.E. Jr. (1975). "An equilibrium model of the business cycle", *Journal of of Political Economy*, Vol. 83, pp. 1113-1144.

Maturana, H.R., & Varela, F.J. (1987). *The Tree of Knowledge*, London, Eng: New Science Library.

Minford, P., & Peel, D. (1983). *Rational Expectations and the New Macroeconomics*, pp. 15-21, Oxford, Eng: Martin Robertson.

Mishkin, F.S. (2007a). "What should Central Banks do?" *Monetary Policy Strategy*, Cambridge, pp. 37-58, MA: The MIT Press,.

Mishkin, F.S. (2007b). "The transmission mechanism and the role of asset prices in moentary policy", *Monetary Policy Strategy*, pp. 59-74, Cambridge, MA: The MIT Press.

Myrdal, G. (1957). "An unexplained general traits of social reality", in his *Rich Lands and Poor, the Road to World Prosperity*, New York, NY: Harper & Row.

Myrdal, G. (1958). "The logical crux of all science", in Streeten, P. (ed.) *Value in Social Theory, a Selection of Essays on Methodology by Gunnar Myrdal*, pp. 231-236, New York, NY: Harper & Brothers Publishers

Myrdal, G. (1958). "The principle of cumulation", in Streeten, P. (ed.) *Value in Social Theory, a Selection of Essays on Methodology by Gunnar Myrdal*, pp. 198-205, New York, NY: Harper & Brothers Publishers

Romer, P.M. (1986). "Increasing returns and long-run growth", *Journal of Political Economy*, Vol. 94, pp. 1002-37.

Sen, A., (1990). "Freedom and Consequences", in his *On Ethics and Economics*, Basil Blackwell, Oxford, Eng.

Shakun, M.F. (1988). *Evolutionary Systems Design, Policy Making under Complexity and Group Decision Support Systems*, Oakland, CA: Holden-Day, Inc.

Skyttner, L. (2005). *General Systems Theory*, Singapore: World Scientific Publishing Co.

Soros, G. (2000). "Reflexivity in Financial Markets", "Reflexivity in History", in *Open Society*, pp. 59-90, New York: Public Affairs.

Toner, P. (1999a). "Nicholas Kaldor (1908-1986) "The marriage of Young and Keynes", in *Main Currents in Cumulative Causation, the Dynamics of Growth and Development*, Chapter 6, Houndmills, Hampshire: Macmillan Press Ltd.

Toner, P. (1999b). "Gunnar Myrdal (1898-1987): circular and cumulative causation as the methodology of the social sciences", in *Main Currents in Cumulative Causation, the Dynamics of Growth and Development*, Chapter 5, Houndmills, Hampshire: Macmillan Press Ltd.

Toner, P. (1999c). "Conclusion", in *Main Currents in Cumulative Causation, the Dynamics of Growth and Development*, Chapter 7, Houndmills, Hampshire: Macmillan Press Ltd.

Von Bartalanffy, L. (1974). *Perspectives on General System Theory*, New York: George Braziller.

Von Mises, L. (1976). *The Ultimate Foundation of Economic Science*, Kansas City, Kansas: Sheed Andrews & McMeel.

Wikipedia, internet version. "Interaction between monetary and fiscal policy". http://en.wikipedia.org/wiki/Interaction_between_monetary_and_fiscal_policies

Yeager, L.B. (1997). *The Fluttering Veil, Essays on Monetary Disequilibrium*, Indianapolis, IN: The Liberty Press, reprint.