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From General Equilibrium to Schumpeter

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ABSTRACT

A simple model of cost innovation in a monetary economy is presented that illustrates the essentially dynamic model of Schumpeter involving breaking the circular flow of capital is logically consistent with the General Equilibrium (GE) model of an exchange and production economy. The GE model as presented by Arrow, Debreu and McKenzie is a non-process model; and the original theory deals with the non-constructive proofs of existence of competitive equilibria (CEs). To associate this theory with GE it is necessary to recast the basic model as a process model. The GE model is enlarged and specified as a playable game by adding rules to describe the mechanisms that carry process.

Although we believe that GE was a great intellectual achievement, it strangled dynamics and the type of low dimensional equilibrium dynamics of the rational expectations school is profoundly misleading. It turns out that, by remodeling GE as a process model even with only one or two strategic moves, Pandora's Box of mechanisms appears and the functions of markets, money and default conditions all emerge as logical necessities.

It is shown that the opportunity for process innovation can be described minimally and formally modeled by considering the availability of a new process as a function of a controlled stochastic variable where success depends on chance modified by the level of investment. The Schumpeterian concept of "breaking the circular flow of capital" appears naturally as a disequilibrium phenomenon where the extra resources are captured by a strategic disequilibrating allocation of money.

1. The circular flow and equilibrium

In a modern economy much of economic activity calls for the use of money and credit, both for decentralization and control. Money, credit and financial institutions provide the links between statics and equilibrium and dynamics and disequilibrium.[1]

General equilibrium deals precisely with equilibrium states. In spite of its elegance and abstraction, as was noted by Koopmans (1977), a general equilibrium theory is pre-institutional. Because the economic world is highly complex and multivariate, radical simplification is called for in the mathematization of the models studied. When process models of general equilibrium are formulated mathematically even the convergence to equilibrium from positions out of equilibrium

[1] A work with which we are in considerable agreement in spirit but different in technique is that of Godely and Lavoie (2007) heavily devoted to a balance sheet and transactions flow model of the monetary and financial control system of a modern economy. This work utilizes simulations and is far closer to applied macroeconomic problems. It also stresses Kaldor's concern with the tendency of economic theorizing to gloss over the difficulties inherent in differentiating stocks from flows.

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in simple dynamic models may be difficult to establish. In contrast the literature on innovation is always process oriented. There is a fast growing approach via agent based simulation (ABM) that provides large scale ad hoc studies to macroeconomic operational problems; but even now an important approach to providing a synthetic overview has been the essay or book as evinced by works such as that of Minsky (1986).

Although originally written over a hundred years ago, Schumpeter's work on The Theory of Economic Development (Nelson and Winter, 1982; Schumpeter, 1934) [1934, 1911] provided an insightful description (in essay form) of a plausible dynamic process involving the interaction of the financial and physical processes of the economy intermixed with the socio-psychological factors of optimism and pessimism. No formal mathematical model was developed.[2]

Here we provide a highly simplified, fully mathematized model of innovation that enables us to show:

1. The pre-innovation circular flow.
2. The breaking of the circular flow at the point of innovation calling for a change in the amount of money in trade.
3. The unavoidable disequilibrium state created and the difficulties in demonstrating if and when an equilibrium is restored.
4. Ownership problems with distribution and creation of fiat money.

The simplest among many alternative models is utilized. We show that a central bank may provide the financing and the variation in the money supply. More complex arrangements are not treated directly here, but when modeled with the same methods would have financiers, private banks or the firms themselves provide the money and the credit.

2. Models with cost innovation

Assume that the probability of the success of an improvement in the efficiency of production (which in a monetary economy can be interpreted as a cost reduction) and its size can be estimated reasonably well. To be specific, we suppose that from an initial production function f, a new improved production function, say g, is obtained with probability $\xi(k)$ after a successful innovation. Here the probability $\xi(k)$ of the improvement is an increasing function of the resources k invested in innovation. With probability $1-\xi(k)$, the innovation fails and the production function is unchanged. (For a given investment the improvement may be two-dimensional, there being a trade-off between the size of the improvement and its probability of success for a given investment. For simplicity, we consider the one dimensional cross section where the improved function g is given and the function $\xi(k)$ is the probability of success.) We assume that $\xi(0)=0$ so that an investment of zero corresponds to no attempt at innovation.

In our models we assume that at the start of the game there is the opportunity for innovation. In essence the first move is a strategic decision to take or reject a gamble to try to improve efficiency. The innovation is modeled as a random event whose value depends on the size of investment.

2.1. Context and circular flow

The title Schumpeter and equilibrium almost appears to be an oxymoron. We construct simple models that achieve a formal mathematization of the fundamental insight that Schumpeter had over a hundred years ago on the need to break the circular flow of finance required in a closed economy in equilibrium when there is the possibility of innovation. Our concern is to be able to illustrate the relationship between real assets and money and debt; noting also that the aspects of banking and who controls the financing become significant at even the most basic level of theory. This requires investigating the nature of the cash flows and how the amount of money, credit, and prices change even in greatly simplified models of innovation.

A literature search (see for example Dosi, 1988; Mazzucato, 2013) indicates that “the breaking of the circular flow” has been hardly treated as consistent with, but beyond General Equilibrium (GE) theorizing. Yet we believe it to be of considerable significance in both the reconciliation of the Schumpeterian approach to Walrasian economics and in going beyond Walrasian equilibrium to develop a basic theory of dynamics.

It helps to provide a basic theoretical justification for applications such as institution rich complex agent based simulations in contrast with the low dimensional neoclassical rational expectations' approaches of the neoclassical school of Robert Lucas and colleagues.

Our prime purpose is to take the steps that show the natural emergence of an evolutionary economics from the basic problems encountered in extending the non-process, nonstrategic, non-institutional, non-context sensitive model into a process model. In doing so even at a high level of abstraction the roles of markets, money, credit, control and bankruptcy emerge.

Our approach is complementary with the applied work in macroeconomics that has existed from at least the time when Keynes pointed out that the reigning theory of competitive markets lacked any coordinating device that necessarily lined up individual behavior with social good.

[2] Many years later Schumpeter (1939) produced two volumes on Business Cycles attempting to fit several centuries of innovation into Juglar, Kitchin and Kondriateff cycles. These provide an encyclopedic tour of innovations but little new light on the generation of cycles. There is little hard evidence for any of these cycles.