

Original Paper

Circular Causation

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Abstract

Circular causation epistemic outlook and model to address the interactively integrated and ever-learning sustainability perspectives in every issue and problem of socio-scientific extensiveness is a novel abstracto-empirical field in contrast to economic and econometric theory in all these aspects. The ensuing episteme and the substantive model of circular causation are introduced. The episteme of unity of knowledge is shown to be the centerpiece of all socio-scientific problems and outlook that methodologically unify by complementarities the otherwise differentiated areas of investigation in the exogenous approach to ethics in economic and econometric theory. Yet this is an introductory paper. The theme of circular causation being distinct from economic and econometric theory is of a vastly methodological nature.

Keywords

econometrics, economics and epistemic, unity of knowledge, empirical inferences

1. Objective

The objective of this paper is to describe the methodology of circular causation as a development approach distinct from econometrics. It is well known from the literature that econometrics came into being a part of economics as a numerical way of understanding economic rationality. This happened even as Keynes (O'Donnell, 1989) was splitting hair over the probabilistic problem of the economic world. He ascribed to it the problem of multifarious elements of economics as being fully unobservable, uncharted, and uncontrollable in deterministic measurement. Keynes thereby thought of getting around this problem of immeasurability caused by subjective probability by way of invoking the principle of economic rationality that entered economic reasoning wholly by way of standardizing certain construed ways of human reasoning respecting economic rationality. Subjective probability, which actually embeds the greater part of the economic universe was turned into measurable probability of

socio-economic events by way of using expectation of such probabilistic occurrence (Keynes, 1908). The behavioral elements underlying the expectation background of converting subjective probabilistic occurrences into measurable ones were determined under the assumption of economic rationality (Lawson & Pesaran, 2009).

2. Economics and Ethics in Epistemological Sense

As a result of construing macroeconomic reasoning by the use of mathematical expectation as a simplification method of converting subjective probability into deterministic probability in econometrics some of the most demanding attributes of the social world were left out. Among these firstly, ethics remained an extraneous implement in economic theory and reasoning. Then there is the absence of methodology in a world-system of fully endogenous inter-variable relations appearing in the form of complete complementarities and participations. These attributes otherwise emerge from the model of the socio-economic and socio-scientific world-system by the inherent epistemological premise of unity of knowledge and its dynamic influence in all the variables by their inter-causal relations.

Thereby, the objective of the wellbeing criterion could not be included in econometric theory. Merely stabilization with potential non-inflationary real output remained the goal by governing the monetary and fiscal policies as exogenous effects on the economic system that remained distanced from the concept of self-governing equilibrium. Consequently, the attainment of full-employment equilibrium in macroeconomics was left to fiscal and monetary policies. The role of consciousness embedded in policy-theoretic forces was not considered even though this consideration remains predominant (Hammond, 1989).

3. Circular Causation Methodology

Some definitional explanations of terms used in the theory and phenomenological model of circular causation

This paper will explain how in epistemic sense, formalism, and application the model of circular causation is different from econometrics. In the area of philosophy and economics this area of study though foundational has been ignored (Toner on Myrdal, 1999). Our focus will be firstly in defining the epistemic meaning of ethics. Ethics will be construed in respect of pervasive complementarities (symbiotic participation) between the goodly choice of representative variables, thus entities and their relations. Such a nature of continuous and complementary inter-variable relations is shown to epistemically arise from the over-powering functioning of unity of knowledge. This episteme remains embedded in the interacting variables in a 100 percent inter-variable endogenous nature of formalism and application of the imminent state of ethical endogeneity excluding ethical exogeneity that enters

economics in differentiation of competing areas.

3.1 Wellbeing Objective Criterion

The induction by unity of knowledge of all variables and their endogenous relations is explained by pervasive complementarities (participation) between the choice variables. We define the imminent objective criterion of the organic relationship of complementary continuity as the ethical representation of Wellbeing. It prevails in the analytical study of all socio-scientific issues and problems in respect of the real-world perspective of ethicality by virtue of the organic interrelationship between diversity of socio-scientific world-systems. Thus, the wellbeing objective criterion is characterized by continuous and most extensive complementarities between variables representing the goodly choices at the learnt exclusion of the socially unwanted ones across diversity of systems. These variables interact, integrate, and learn under the impact of the episteme of unity of knowledge.

3.2 Circular Causation

Circular causation as the theory of 100 percent endogenously interrelated theory inter-connecting all the selected variables of the objective criterion in an ethical socio-scientific world-system. This is centrally grounded on the epistemic foundation of unity of knowledge between the good things of life. Unity of knowledge is explained by pervasive complementarities and systemic participation between the good things that are manifest by interrelationships between the representative variables in the light of satisfying the attainment of wellbeing as the universal socio-scientific objective.

3.3 Ethicality

In the epistemic explanation of a reconstructive ethical world-system, ethicality is defined in terms of such emergent complementary (participatory) world-system explained by the interrelating variables and their phenomenological, that is conscious, unity and continuity of the interactive, integrative, and evolutionary dynamics of inter-relational learning. The existence and representation of the emergent good choices at the exclusion by discursive knowledge of the unrecommended opposites are represented by their relational inter-causality as endogenous relations between all such variables is the meaning of ethicality. This central feature of the theory, formalism and application of circular causation arises out of unity of knowledge denoted by “ θ ” as the evolutionary epistemic embedding in the variables of the goodly choices (Note 1).

3.4 Sustainability

The property of interaction is explained in the process of formation of “ θ ” embedding the variables as measures of consciousness based on the episteme of unity of knowledge. This is followed by expectational convergences to punctuated equilibriums by the force of “ θ ”. Interaction and integration in such dynamics recursively continue on into new and continuous processes of the same kinds of interaction leading to integration. Interaction to integration thus lead into continuously evolving participatory knowledge formation and their inter-variable embedding. This continuity explains the

property of sustainability.

Sustainability is never-ending by virtue of the continuous and creatively discursive nature of formation of “ θ ” and its embedded choice variables. Emergent policy and institutional consequences thereby reconstruct newer processes of evolutionary learning caused by intra- and inter- systemic rounds of sustained evolutionary epistemic meaning of sustainability. In and across such dynamics of circularly recursive and non-ending processes of sustainability the property of complementarities and participation in a systemic sense of inter-relations intensifies and conveys newer theoretical, institutional, applied and creative inferences.

4. Empirical Meaning of Complementarity

The impact of inter-variable continuous circular causal relations across intra- and inter- systemic evolutionary learning processes is conveyed by the statistical degree of positivity of the inter-variable simulated coefficients. This kind of estimated result occurs both within a given system-learning or across many systems-learning. Thereby, the character of evolutionary interactive, integrative, and evolutionary properties explains the diversity of learning across evolutionary learning processes. The reconstructed inter-variable coefficients thereby yield the degree of policy-simulated sensitivity effects on the inter-variable circular causation in the light of unity of knowledge as defined by their wellbeing impact (Fitzpatrick, 2003).

A discursive nature of impact on the determination of the participatory coefficients is an important character of the dynamics of evolutionary learning processes along the sustainability path of wellbeing as the objective criterion of unity of knowledge impacts upon the choice variables and their implications. The discursive nature of interaction, integration, and evolutionary learning implies complementarities between all forms of diverse and widely different systems that despite being so are inter-relational domains in the context of attaining wellbeing and replacing systemic individualism with organic unity of being and becoming with beneficial socio-scientific impact.

An example of this kind of systemic unity of knowledge conveying organic symbiosis of inter-relations can be found in the reflective understanding conveyed by Kant (trans. Friedrich, 1949, p. 261) in his wise words: “Two things fill the mind with ever new and increasing awe and admiration the more frequently and continuously reflection is occupied with them; the starred heaven above me and the moral law within me. I ought not to seek either outside my field of vision, as though they were either shrouded in obscurity or were visionary. I see them confronting me and link them immediately with the consciousness of my existence”.

Koizumi (1993, p. 143) writes regarding a relational system of global interdependence: “If the world is to be managed at all, it needs to be managed as a social system. This means that the world must be seen as a system consisting of the sub-systems of culture, economy and polity which, though they

complement one another, nevertheless conflict one another as they are systems which address themselves to rather different sets of issues in human affairs”.

The above kinds of prelude to every socio-scientific ideal does not even escape religion as a systemic study of unity of being and becoming in belief and the scheme and order of things. The essential example of this case is of monotheism as law prevailing as explanatory realm of unity of knowledge in the multiverse of organically interrelated “everything”. On such religious matters affecting worldly actions in the framework of the monotheistic law embedded in the details and generality of the world-system Ghazali (trans. Karim, n.d., p. 237, edited) wrote: “What is monotheism? Know O readers, that God—reliance is a door out of the doors of faith. All the doors of faith are not kept in order except with knowledge, condition, and action. Out of these three elements, God-reliance is born. Knowledge is the basis; action is its fruit”. Buchman (1998, p. 38) further explains the understanding of the epistemic unity of knowledge by Ghazali: “Knowledge is above faith, and tasting is above knowledge; [this] because tasting is a finding, but knowing is a drawing of analogies, and having faith is a mere acceptance through imitation”.

5. The Methodological Impossibility of Econometrics

All such diverse and apparently different systemic realms are impossible of studying by the methodology of economic rationality and the rationalistic formulation of econometric model in the presence of ethical exogeneity in all of economic theory. There is therefore no theory, application and continuity of epistemic consciousness of ethicality in the entire domain of economic theory, contrary to the case of socio-scientific phenomenology. The embedding of consciousness is nonetheless central to the establishing of the holistic methodological worldview of the generality and details of socio-scientific understanding of the multiverse. Michio Kaku (2015) refers to the integrated view of man and nature in the totality of the conscious being and becoming of phenomenon in the following words: “Consciousness is the process of creating a model of the world using multiple feedback loops in various parameters (e.g., in temperatures, space, time, and in relation to others), in order to accomplish a goal (e.g., find mates, food, shelter)”. Kaku also refers to this explanation of phenomenological consciousness as the “space-time theory of consciousness”.

In brief therefore, Circular Causation as a theory and model of the epistemic methodology derived from the premise of unity of knowledge and driven by completely endogenous inter-relations between the variables of the goodly choice, while avoiding and reducing the unrecommended choices, addresses interactive factors of the socio-scientific world-system. These congeries of factors leading to explained consequences, formalism, and applications in all integral matters of the vastest realms of the socio-scientific worldview is possible by circular causation. The same mutated constructs of exogenous treatment of ethics and statistically independent variables are the permanent features of econometrics in

particular and economic theory in general.

6. Formalism of the Circular Causation Concept

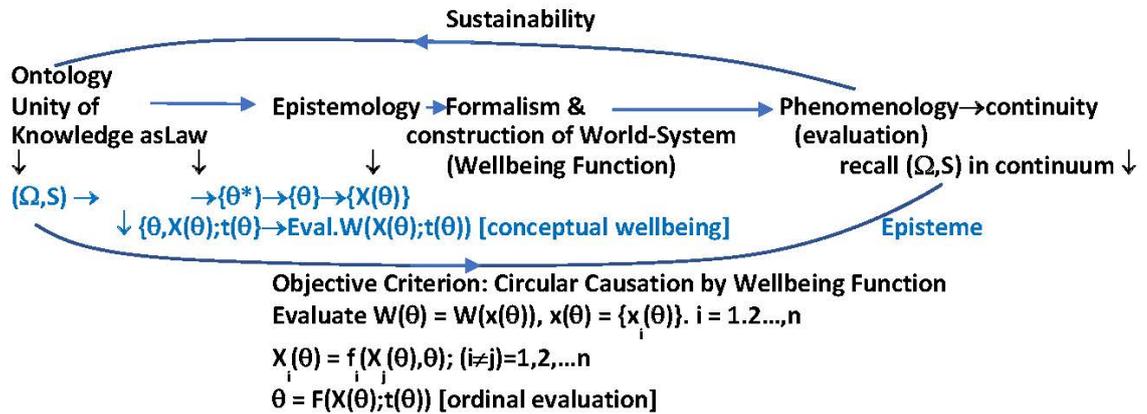


Figure 1. Schema of Deriving Analytical Construct of Wellbeing from the Ontology of Unity of Knowledge

7. Example: the Circular Causation Model

In a formal context, the construct of Circular Causation Model makes a substantive difference from the overall formalism and epistemic grounding of econometric theory. Contrary to the pervasive existence of complementarities, economics and econometric theory marginalize the expectation theory of subjective probability affecting economic occurrences. To explain the nature and difference between circular causation and econometric theories in such a case of differentiation we continue on to use the variables of footnote 1.

Let $y(\theta) = (p, pr, R, h, IL(H), \theta)[\theta]$. This is treated as a reconstructed vector $x(\theta) = (x_1, x_2, x_3, x_4, \theta)[\theta] = (p, R/p, h/pr, IL(H)/pr, \theta)[\theta]$, one-to-one. (1)

The corresponding wellbeing function is firstly expressed as the theoretical derivation from the earlier explained epistemic foundation of unity of knowledge by complementarities between the representative entities of the functional variables of goodly choice:

$$W(\theta) = W(x(\theta)), \text{ with } dx(\theta)/d\theta > 0 \tag{2}$$

for each of the variables by the property of continuity and representations of the good choices of the variables, formalizes the wellbeing objective criterion. This can be empirically evaluated on the estimation and simulative contexts with the imminent inter-variable circular causation relations from which alternative policy-inferences can be derived.

By the property of circular causation of full endogeneity of continuous complementarities and induction by the knowledge variable embedded in the variables we derive the relevant circular

causation equations:

$$x_i(\theta) = f_i(\mathbf{x}_j(\theta)). \quad (3)$$

$\theta = F(\mathbf{x}(\theta))$; with $d\mathbf{x}(\theta)/d\theta > 0$; $d\theta = \sum_{\mathbf{x}(\theta)} (\partial F(\mathbf{x}(\theta))/\partial \mathbf{x}(\theta)) * d\mathbf{x}(\theta) > 0$, identically by individual terms and $\mathbf{x}(\theta)$ -variables denotes the linear approximation of the generalized polynomial function in “ θ ” as the empirical form of the wellbeing function in expression (2). (4)

In the generalized system of inter-causal variables by the organic property of complementarities and continuity as of sustainability of the episteme of unity of knowledge of the functions $f_i(\cdot)$, we write, $i, j = 1, 2, \dots, n$; $i \neq j$. The functional form of $f_i(\cdot)$ can appear in diverse but appropriate forms to convey the properties of endogeneity, organic complementarities, continuity and mathematical differentiability via the presence of unity of knowledge represented by “ θ ”.

Our selection of the full $f(\cdot)$ function in $\mathbf{x}(\theta)$ -vector of variables is taken in the non-linear product form, $f(\mathbf{x}(\theta)) = A(\theta) * \prod_{k=1}^n x_k(\theta)^{a_k(\theta)}$. Non-linearity is implied here by the probabilistic nature of the coefficients in their simulation varieties. (5)

This is log-linearized with the simulation dynamics of the embedding “ θ ”-parameter in all the variables and coefficients.

The full system of circular causation relations is given by,

$$x_i(\theta) = f_j(\mathbf{x}(\theta)) = A(\theta) * \prod_{j=1}^n x_j(\theta)^{a_j(\theta)}; i, j = 1, 2, \dots, n; \text{ and } n=1, 2, \dots, 4 \text{ in reference to footnote 1.} \quad (6)$$

The additional equation that gives a linear approximation in “ θ ” as the estimable wellbeing function of the theoretical form (2) is the following one. Non-linear forms of “ θ ” underlie the transformation as a linear transformation of the generalized polynomial function in “ θ ” as the empirical form of the wellbeing objective criterion,

$$\theta = f(\mathbf{x}(\theta)) = A(\theta) * \prod_{k=1}^n x_k(\theta)^{a_k(\theta)}, \quad (7)$$

with $d\theta = \sum [\partial f(\mathbf{x}(\theta))/\partial \mathbf{x}(\theta)] * d\mathbf{x}(\theta)/d\theta > 0$, identically by terms.

The coefficients, $\{a_k(\theta)\}$, $k = 1, 2, \dots$ denote inter-variable partial elasticity values. These coefficients are subject to simulation by assigning inferential values for improving the degrees of complementarities between the estimated variables and deriving socio-scientific inferences from such simulations.

The generalized circular causation model is given by equation (1)-(6). Equation (2) is not empirically viable. Yet it is required for theoretical derivation of the wellbeing function corresponding to its epistemic foundation of unity of knowledge.

8. Conclusion

We conclude by addressing the above-mentioned circular causation model in its particular case of vector (1). We argue that, circular causation theory and implications are distinct from econometric theory and modeling in respect of the exogenous treatment of ethics in this model.

Either by estimation with the use of varied statistical methods and by simulation by re-assignment of the partial elasticity coefficients $\{a_k(\theta)\}$, $k = 1, 2, \dots$ as applicable by way of the inter-related variables, Table 1 applies to the case of circular causation results that are contrary to econometric results.

Table 1. Circular Causality Effect between Variables of Ethical Choices of Complementarities

inter-causality	$a_1: p(\theta)$	$a_2: (R/p)(\theta)$	$a_3: (h/pr)(\theta)$	$a_4: (IL(H)/pr)(\theta)$	$a_5: \theta$
$x_1: p(\theta)$	1, $p(\theta)$ stabilizes with θ increasing by the goodly choice of variables	+, Real resources increases with θ increasing, $p(\theta)$ stabilizing	+, $h(\theta)$ increasing alleviates poverty, $pr(\theta)$, as θ increases and enhances $p(\theta)$ -stability	+, $IL(H)(\theta)$ decreases and enhances health $H(\theta)$ as $pr(\theta)$ alleviates with θ increasing	+, price stability is enhanced with θ increasing by the goodly choice of variables
$x_2: (R/p)(\theta)$	+, as $p(\theta)$ stabilizes real R increases with increasing θ	1, real value of resources increases with θ enhancing its positive effect on real $R(\theta)$	+, $pr(\theta)$ alleviates as $h(\theta)$ increases with θ increasing	+, increasing real resources are enhanced by improving $H(\theta)$ while IL declines as θ increases	+, real resource are affected as $p(\theta)$ stabilizes with θ increasing by the goodly choice of variables
$x_3: (h/pr)(\theta)$	+, price stability affects $h(\theta)$ along with $pr(\theta)$ as θ increases	+, increase in real resource enhances $(h/pr)(\theta)$ as $pr(\theta)$ decreases with θ increasing	1, increasing θ simultaneously enhances $h(\theta)$ and $pr(\theta)$ relationship towards stability of $(h/pr)(\theta)$	+, $IL(\theta)$ decreases and $H(\theta)$ enhances to cause positive effect on $h(\theta)$ and $pr(\theta)$ (poverty alleviation), with θ	+, wellbeing increases with knowledge and enhances $h(\theta)$ and poverty alleviation $pr(\theta)$ by the

				increasing	goodly choice of variables
$x_4:$ $(IL(H)/pr)(\theta)$	+, p-stability enhances health by reducing illness as poverty alleviates with increasing θ	+, real resources enhances expenditure in $H(\theta)$ and thereby reduction in $h(\theta)$ as the simultaneous effect of poverty alleviation enhances with θ increasing	+, increase in $h(\theta)$ with reduction in $pr(\theta)$ as θ increases positively affects $(IL(H)/pr)(\theta)$	1, $IL(H)(\theta)$ and $pr(\theta)$ simultaneously respond positively to increasing θ	+, wellbeing increases along with knowledge and enhances $H(\theta)$ and affects poverty alleviation $pr(\theta)$ by the goodly choice of variables
$\theta: W(\theta)$	+, sustainability property of inter-variable endogeneity and mathematical continuity of the variables regenerate further processes of evolutionary learning in wellbeing increases with knowledge and enhances	+, same sustainability effect of circular causation between all variables of ethical choices (estimation and simulation)	+, same sustainability effect of circular causation between all variables of ethical choices (estimation and simulation)	+, same sustainability effect of circular causation between all variables of ethical choices (estimation and simulation)	+, θ is a linear expression of wellbeing That can be non-linear and bear complex expression

h(θ) and
poverty
alleviation θ

The above formalism of circular causation in respect of every problem by virtue of the episteme of unity of knowledge, pervasive complementarities represented by variables of the goodly choices embedded in unity of knowledge and included in the wellbeing criterion by virtue of the goal of attaining ethicality, are all absent in econometric theory. This inadequacy is caused by the methodological impossibility of addressing endogeneity of ethics in economic theory throughout. Ethical exogeneity has been introduced in econometrics even though the ethical worldview was permanently in the mind of Keynes in his General Theory (Keynes, 1908).

An example of this case of ethical exogeneity against ethical endogeneity can be seen by the marginalist substitution property as of neoclassical economic theory that entered econometrics. In economic theory, price stability can exist as a stabilization goal in the face of prevalence of poverty. Likewise, resource increase and human development can persist in the face of persistence of poverty and inflationary condition. The pursuit of economic growth and efficiency can continue in the face of deepening poverty. Thereby, in all such cases, \mathbf{x} -vector of variables remain in conflict. Consequently, the epistemic origin of endogenous ethics and the possibility of pervasive complementarity, interaction, and evolutionary integration (punctuated equilibrium), and evolutionary learning, as in the definition of sustainability as a continuum phenomenon, all attained by knowledge denoted by " θ ", cannot be treated as methodological element in economics and econometric theory. Thus, ethics forever remained an exogenous consideration. Economics assumes that ethics arises exogenously in other separated socio-scientific disciplines.

Yet in the holistic policy-theoretic socio-scientific study of all human and social issues explained by the wellbeing objective criterion, the broadest discursive and interactive function of epistemic unity of knowledge prevails. This matter is particularly found to be a pronounced fact in the economy-pandemic conflict in policy-theoretic treatment of the Covid-19 case as a matter of the utmost importance.

The details of the study of circular causation are a substantive study in terms of its embedding by the episteme of unity of knowledge via the processes of formalism, model construction, empirical applications and continuity with potential policy-theoretic inferences. These details can be found elsewhere (Choudhury, 2020, 2017).

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Notes

Note 1. Let the vector of inflationary price variable (p); poverty variable (pr); distribution of resources (R); human development (h); and illness (IL), contrarily H health as to be denoted by, $\mathbf{x} = (p, pr, R, h, IL(H))$. The goodly variables are (R, h, IL(H)). The contrary variables are (p, pr). Of the various

ways of transforming these variables into target variables of the goodly type for attaining human wellbeing as the objective, we can denote the choice vector as, $(R/p, h/pr, IL(H)/pr)$. The target socio-economic variables in this form of the vector are R/p , real resources; h/pr , human development by controlling poverty pr . $IL(H)/pr$ gains by controlling illness IL by poverty alleviation pr and enhancing H . There can be other definitional construction of the target variables.

The interrelations between these variables in the wellbeing objective criterion are caused centrally by the endogenous effect of unity of knowledge as the epistemic derivation. Unity of knowledge as the property of knowledge formation in such an endogenously inter-relational system is denoted by “ θ ”. The continuous properties of sustainability by recursive cause and effect between deductive and inductive reasoning in the chain of evaluation of the wellbeing criterion, and thereby of the recursive interrelationship between noumena and phenomena (Kant, 1964) are put into mathematical continuity by the embedding dynamics of “ θ ” affecting the relationship and the formation of ethicality in the inter-variate sense. “ θ ” is thereby the epistemic foundation of circular causation between the variables, which gives the meaning of inter-variate endogenous causality in the circular causation system of equations arising from the following θ -induced vector of goodly variables of choice. We therefore write the functional vector of circular causation as, $\mathbf{x}(\theta) = (p, pr, R, h, IL(H), \theta)[\theta]$, commonly induced by the circular cause and effect of inter-relations between the variables and their epistemic interaction, integration and evolutionary episteme (Foucault, 1972).