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The Methodology and Multifaceted Role of Models in Economic Theory: Between Abstraction and Application

[1] Idisi PO, [2] Adeagbo BA, [3] Ogwu IJ, [4] Lawal AS, [5] Unamba FC, [6] Idris MI, [7] Uyaeme OS, [8] Abdulkadir KO

[1, 2, 3, 4, 5, 6, 7, 8] Department of Agricultural Economics, Faculty of Agriculture, The University of Abuja, PMB 117, Abuja, Federal Capital Territory, Nigeria

Corresponding Author: **Unamba FC**

Abstract

Models have become an essential to contemporary economics, but the methodological underpinnings of these models and their philosophical position are still being debated. This paper critically examined the methodological foundations of economic modelling, and specifically through the lens of abstraction, assumptions, formalization, and calibration versus econometric estimation. The article discussed economic models as an explanatory tools that elucidate the processes of causation, predictive tools that help forecast future, policy laboratories to simulate interventions, and conceptual models that help speculate the theoretic implications. Meanwhile, some important limitations were identified. The weaknesses of model-based reasoning were underscored by over-simplification, the issues brought up by the Lucas Critique as well as the philosophical arguments on realism versus instrumentalism in general. The analysis puts these tensions in the context of the poles of abstraction and application implying that the strength of models is not on their correspondence with reality but rather on their ability to organize the economy in a logic manner and to direct one to its inquiry. The article concludes with the identification of new methodological horizons such as agent-based modelling and machine learning that could change the role of models in economic theory.

Keywords: Methodology, Economic Modelling, Abstraction, Simplification, Assumptions, Prediction, Policy Analysis, Lucas Critique

1. Introduction

In contemporary economics, economic models play a central role as the main tool that is used to express, test, and exchange theories (Morgan & Knuuttila, 2012) [35]. They are significant because they can reduce complex realities into manageable structures that allow the economist to examine both causal processes and making forecasts. The twentieth century marked the beginning of increased mathematization of economics as of form of inquiry into economic phenomena (Debreu, 1991; Scott, 2018) [10, 46]. This progression however has however led to some methodological controversy. On the one hand, models are being glorified due to their ability to give clarity, accuracy, and consistency in the economic thinking (Sugden, 2000, Gilboa *et al*., 2014) [50, 20]. Critics on the other claim that overly formalizing economic models brings risks of dissociating economics from empirical reality, thus creating elegant but irrelevant account of economic life (Pratten, 2004) [39].

This classification of economic models is powerful but has limitations since it leads continuous debate in economic methodology. To others, models can be viewed as credible worlds or fictions that allow one to discuss hypothetical situations instead of describing actual reality (Sugden, 2009; Hardt, 2007) [51, 24]. Some believe that their usefulness is determined by predictive success, repeating the instrumentalist defense of Friedman (1953) [16] of the unrealistic assumptions as long as the model is successful. However, empirical failures, e.g. the failure of the Dynamic Stochastic General Equilibrium (DSGE) models to predict or elucidate the 2008 global financial crisis have fueled criticism of mainstream modelling practices (Marchionatti & Sella, 2017) [33]. The article thus focuses on the influence of methodological decision making on the strength and weakness of economic models through strategies that include; abstraction, assumptions, formalization and model-data strategies.

Based on the discussion so far, the guiding question for this analysis is: "*To what extent do methodological foundations influence the role of models as an explanatory, predictive and policy making tools in economics?".* Basically, it is an analysis

of methodological basis of economic modelling and the various roles it plays in economic theory. Although, with reference to particular traditions, like DSGE or agent-based modelling which are provided as an illustration, the article is not an attempt of a complete technical survey. Rather, it is subject to critical evaluation of the epistemic status of models as explanatory tools, predictive tools, policy laboratories or conceptual tools, and with emphasis on the controversies that encompass each of these roles.

The article is organized in the following structure. Section II is a review of economic modelling methodology - abstraction, assumptions, formalization and methods of connecting models with data. Section III provides the multifaceted role played by models in explanation, prediction, policy analysis and conceptual exploration. Meanwhile, Section IV includes the critiques and limitations - over-simplification, Lucas Critique as well as philosophical arguments of realism versus instrumentalism. The final section - Section V concludes the paper with summary of findings as well as speculations on new methodological innovations including computational and machine-learning models that are emerging.

2. Methodology of Economic Modelling

2.1 Abstraction and Simplification

One of the methodological characteristics of economic modelling is abstraction, which enables an economist to simplify complexities in real-world situations for better comprehension (Rappaport, 1996) [40]. Simplification have become essential since economic phenomena are too complex to be analyzed in its entire empirical richness (Hausman, 1992) [25]. As an illustration, Demand-supply models or IS-LM models are successful specifically because they simplify the economy to only a few variables. Nonetheless, this is a methodological strength that is somewhat debatable. It was argued that too much abstraction can create dichotomy between economics and social ontology and come up with logically consistent but empirically irrelevant models (Pratten, 2004; Lawson, 2019) [39, 30]. Correspondingly, Colander *et al*. (2008) [8] believe that the macroeconomic models that are highly abstracted may conceal the institutional and historical environments under which real economies are constructed. A longstanding methodological conflict is evident in this debate: should abstraction be considered in terms of its ability to simplify reality in order to deal with it in a manageable manner, or in terms of its ability to represent complex systems that it is intended to represent.

A classic example of abstraction could be illustrated with the use of the Cobb–Douglas production function (Cobb & Douglas, 1928) [5] (see fig. 1). This model simplifies complex process of production into manageable and simple mathematical form.

$$Y = AK^{\alpha}L^{1-\alpha}$$

Where:

- Y = total output,
- A = technology parameter,
- K = capital input,
- L = labor input,
- α = output elasticity of capital.

Source: Cobb and Douglas (1928) [5]

Fig 1: Cobb-Douglas production function

The model supposes that the returns to scale are constant and there is seamless substitutability between labour and capital. While it provides analytical tractability and has been extensively employed in the theory of production, critics claim that it oversimplifies the production process since it does not account for institutional, technological and sectoral heterogeneity (Romer, 1990; Sredojević *et al*., 2016) [42, 48]. This conflict exemplifies the larger approach to trade-off in methodology between realism and abstraction in economic modelling.

2.2 The Role of Assumptions

Economic models are constructed also on the basis of assumptions, though controversial as the methodological legitimacy is still under debate. The most well-known defense of Friedman (1953) [16] on unrealistic assumptions which state that it does not matter whether assumptions are true, so long as the model produces accurate predictions, has been very influential in mainstream economics till date. By contrast, critics including Musgrave claim that implausible assumptions undermine the credibility of explanation and can give rise to erroneous policy advice (Todd, 2018) [53]. Indicatively, while assumption of representative agents in the Dynamic Stochastic General Equilibrium (DSGE) models is helpful in the sense that it enables the models to be tractable while omitting the issue of heterogeneity and network effects that played a significant role during the global financial crisis (Gallegati, 2018; Haldane & Turrell, 2019) [17, 23]. This implies that the assumption of a homogenous agent do not account for other factors that drive macro-economic phenomena. Thus, the issue of methodological debate, as such, is not part of whether assumptions are realistic or not, but how they lead to what models can legitimately say they can explain or predict.

2.3 Formalization and Mathematical Representation

Mathematical economics have been described as a symbol which gives scientific quality to economics (Weintraub, 2002) [57]. Mathematical formalization guarantees accuracy, logicality, and clarity in the drawing of conclusions, which is not the case with more discursive social sciences (Renze, 2024) [41]. The prominence of mathematics in modelling, however, is also a subject of controversy. Backhouse (2010) [1] cautions that formalism may degenerate into the art of proving theorems that have little to do with the empirical reality. Similarly, Moosa (2021) [34] opine that:

> "While the use of mathematics can be useful for the exposition of economic theory, the mathematization of economics has been taken too far, to the extent that the means has become an end in itself" (Moosa, 2021:1) [34].

According to Lawson (2012), [29] obsession with mathematical representation marginalizes significant social structures and causal processes which are simply not formalizable. On the other hand, advocates respond that formalization makes economic reasoning more disciplined and allows it to proceed cumulatively (van Zijp & Visser, 2002) [54]. Drawing from these controversies, the issue of methodology then arises as to whether the benefits in mathematical rigor are greater than the costs of restricting the scope of investigation, particularly in the circumstances

where the phenomena like institutions, norms and uncertainty do not lend themselves to mathematical analysis.

2.4 Calibration vs. Econometric Estimation

Strategies of parameterization including the calibration and econometric estimation can mediate the relationship between models and empirical data. Calibration is commonly applied in macroeconomics, and parameters are chosen to be able to reproduce some modified facts in models (Gomme & Rupert, 2007) [21]. Proponents claim that this methodology provides internal consistency and prevents overfitting, which makes models applicable to experiments on policies. Critics however, observe that calibration is usually subjected to arbitrary decisions thus compromising empirical credibility (Vanni *et al*., 2011) [55]. In contrast, econometric estimation extracts parameters out of statistical analysis and builds models which are based more solidly on data (Nevo & Whinston, 2010) [38]. However, econometric techniques have their own shortcomings especially in the area of identification and model specification which according to Dufour (2003) [13] may give misleading inferences. In sum, the calibration versus estimation methodological debate raises critical question: is empirical robustness be given more relevance or theoretical elegance should be given a priority?

3. The Multifaceted Role of Models

3.1 Explanation

The ability of economic models to explain observed phenomena by isolating causal mechanisms in complex economic systems is one of the key functions of economic models (Morgan & Knuuttila, 2012) [35]. As an example, the supply and demand models can be used to demonstrate how the changes in preferences or technology can change the equilibrium prices. These explanatory constructs offer intellectual elucidation, as they enable the economists to understand how micro-level phenomena produce macro-level effects (Gräbner & Kapeller, 2024) [22]. Nevertheless, these models have been criticized as having weak explanatory potential: simplifying agents into representative actors or assuming frictionless markets, diverging from real-life economic processes (Lawson, 2019) [30]. This debate is therefore supported by a more philosophical discussion as to whether models actually explain, or are just heuristic tools to structure thought (Ross, 2013) [43].

3.2 Prediction and Forecasting

Another key role of models is their predictive power, which especially in macroeconomics models are regularly examined to forecast growth, inflation, or unemployment (Sermpinis *et al*. 2014; Chakraborty *et al*., 2021) [47, 4]. The econometric models and Dynamic Stochastic General Equilibrium (DSGE) models have played significant roles in this respect. The proponents of predictive power of models believe that these models would discipline economic forecasting, as they are based on theoretical consistency (Lucas, 1976; Lehtinen, 2021) [32, 31]. However, the financial crisis in the global scale of 2008 has revealed their weakness: numerous powerful models could not predict system risks, which supports the ideas that predictive proclamations in economics are weak (Colander *et al*., 2008) [6]. Although, there are scholars who cite the lack of financial frictions and behavioral factors in prediction as a reason behind the failures (Driscoll & Holden, 2014), [12] others are categorical that prediction in social systems will always be inherently bound by reflexivity and uncertainty (Hendry and Mizon, 2016) [26]. Therefore, predictive power of models on the one hand is very important and useful, but its epistemological status remain a subject of debate because of its potential failure as witness in the 2008 financial crisis.

3.3 Policy Analysis

Models are also used as laboratories of policy analysis whereby an economist is allowed to test counterfactual issues that is difficult to carry out in a real world policy making (Mowery, 1983) [37]. As an illustration, computable general equilibrium (CGE) models are popularly used to predict the impact of a liberalization of trade or taxation (Taylor & Von Arnim, 2007) [52]. Advocates of this role posit that these models provide policymakers with organised information on the possible consequences of interventions and thus help them in evidence-based decision making (Dada *et al*., 2024) [9].

The Lucas Critique does however highlight a basic drawback of this role of model in policy analysis - when policies vary, the structural relations which are postulated in models can themselves vary and invalidate the policy prescriptions which are based on the stated models (Lucas, 1976) [32]. More so, it is noted by critics that the models employed in policy context frequently give preference to some ideological or normative assumptions, including efficiency instead of equity, so they are not as neutral as they are presented to be (Dutt *et al*., 2025) [14]. This therefore raises significant issues concerning the power of models to influence the public policy and economic governance.

The IS–LM framework is a simple model used in demonstrating how economic models are being used in the context of policy analysis (see fig. 2).

The IS curve (goods market equilibrium):

$$Y = C(Y - T) + I(r) + G$$

The LM curve (money market equilibrium):

$$M/P = L(Y, r)$$

Where:

- Y = income/output,
- r = interest rate,
- C = consumption function,
- I = investment function,
- G = government expenditure,
- M/P = real money supply,
- L = liquidity preference.

Source: Hicks (1980) [27]

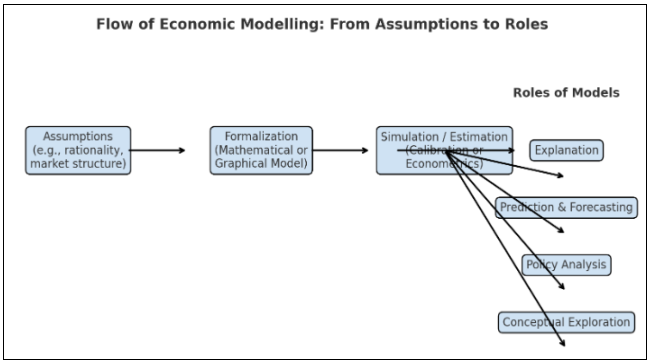
Fig 2: The IS-LM model

This model indicates the shifts in the IS or LM curves could occur by either fiscal expansion or monetary expansion. Such models are common in the process of policy-making as policy makers seek to simulate counterfactual policy impacts. The Lucas Critique however cautions that as soon as the policy becomes different, agents shift their expectations, thus disrupting the stability of such relationships (Lucas, 1976) [32]. Overall, while it can be useful in the short-run analysis, IS-LM may not be helpful in reflecting on a more profound structural dynamics.

3.4 Conceptual Exploration

Models are also used as conceptual exploratory tools in addition to the explanatory, predictive, and policy models. Here, they are used as thought experiments in shedding light on the logical consequences of assumptions and the limits of theoretical constructs (Sugden, 2000) [50]. Indicatively, neither the well known Solow growth model nor the Arrow-Debrue's general equilibrium model appeared as a direct predictive tool, but rather as an exercise in making clear what would happen under the assumption of certain axioms. This exploratory role has been recognizable as one of the most fruitful intellectual jobs of economic modelling (Morgan, 2012) [35].

However, critics have claimed that over-emphasizing highly abstract thought experiments makes economics entirely irrelevant to empirically meaningful phenomena (Drakopoulos, 2016) [11]. This could therefore reduce economics to the sterile, and a priori game of formalism (Coyle, 2010) [7]. Other proponents justify this strategy by saying it is necessary step to achieve cumulative theorizing, observing that even unrealistic models can suggest empirical research programs (Verreault-Julien, 2017) [56].



Source: Authors' Conceptualization

Fig 3: Flow of economic modelling

4. Critiques and Limitations

4.1 Over-Simplification

One of the ongoing criticisms of modelling in the field of economics is that abstraction may become overly simplistic, and that important institutional, historical and social complexities face negligence. Those who believe in simplification claim that whole purpose of modelling revolves around simplification which empowers a researcher to isolate mechanisms which would otherwise be hidden (Friedman, 1953; Morgan, 2012) [16, 35]. Critics however respond that abstraction can easily degenerate into distortion, implying that models which suppose the existence of representative agents, rational expectations, or frictionless markets can ignore exactly that which real world processes care most about (Lawson, 2012) [29]. This tension was brought forward with the 2008 financial crisis where the dominating macroeconomic models failed to consider the systemic risk and network effects in financial markets (Colander *et al*., 2008) [6]. As such, what one might consider as analytical clarity, another might criticize them as a methodological blindness.

4.2 The Lucas Critique

The Lucas Critique is considered one of the most significant criticisms to conventional econometric modelling. Lucas (1976) [32] proposed that the historical-based models are distorted by any change in policies - as agents change their expectations and the relationships that the model assumes are not affected by such change. This understanding redefined macroeconomics and it gave way to micro-founded DSGE models. Advocates argue that the Lucas Critique promoted methodological rigor because it required economists to redefine models on clear behavioural assumptions (Sargent, 2009; Sargent & Vilmunen, 2013) [44, 45]. Critics however make case for mixed empirical effect, that while DSGE models help to meet the internal consistency requirement, they tend to be empirically weak and cannot explain crises (Stiglitz, 2018; Gallegati, 2018) [49, 17]. In this respect, the Lucas Critique addressed certain methodological problems while leaving some other ones unaddressed.

4.3 Philosophical Debates

Beyond technical issues raised by models, there are philosophical questions concerning the nature of economic knowledge. While some consider models as near truths about the the real world just as seen in scientific laws of physics (Da Costa & French, 2003); [8] others see them as heuristic tools or reasoning tools, rather than mirrors representing reality (Sugden, 2000; Gigerenzer, 2000; Moscati, 2024) [50, 19, 36]. The instrumentalist view popularly stated by Friedman (1953) [16] notes that irrespective of whether the assumptions used in a model are realistic; they suffice as long as they predict correctly. Critical realists believe on the contrary, that unrealistic assumptions might weaken the depth of explanation and become obstacles in recognizing causal mechanisms (Lawson, 2012, Lawani, 2021) [29, 28]. The consequences of this philosophical divide are severe - while instrumentalists are champions of the pragmatic utility of models, realists warn against the inference of scientific truth by predictive convenience of models. The debate in this context is indicative of the unresolved position of the model in economics as not necessarily a universal truth, but as a disputed influenced by methodological, epistemological and ideological commitments.

5. Conclusion

5.1 Synthesis of Findings

The methodological basis as well as the various uses of economic models have been extensively discussed in this paper, focusing on the fundamental role of explaining, predicting, policy analysis and exploring concepts. Models give order to otherwise unmanageable complexities, which are essential tools to economists. However, it is this ability to simplify - its key strength which also reveals its most critical weakness (over-abstraction) that could create distortions. The Lucas Critique and related philosophical discussion have further placed emphasis on the fact that models themselves are not unbiased reflections of reality, but rather a construction whose validity and credibility are determined by both their internal consistency and their applicability to the real world situations.

5.2 Future Directions

In prospect, the future of economic modelling seems to be influenced by two major tendencies. To start with, methodological innovation is moving towards computational methods (agent-based modelling and network analysis), which strive to model heterogeneity, interactions, and

emergent properties (Bohlmann *et al*. 2010; Gallegati, 2018) [3, 17]. Second, the opportunities of applying big data to economic analysis are growing due to the development of machine learning and data-driven solutions, which can add to the range of traditional, theory-based models and offer predictive instruments (Elragal & Klischewski, 2017; Bickley *et al*., 2025) [15, 2]. Although these methods have potential, they might also pose a danger of developing new methodological problems: models could lead to a lack of transparency and interpretability of economic reasoning in 'black boxes'.

5.3 Final Statement

Finally, economic models are either potent or constrained: they offer an insight into some of the realities while they ignore some others. Thus, Their further application require intellectual honesty and methodological pluralism - acknowledging that there is no one modelling strategy that is sufficient to capture the richness of economic reality. With economics facing the problems of globalization including financial crises, climate change, and technological disruption; the ability of the economic discipline to alter its modelling practices will be essential. Models are therefore not seen as absolute representation of the economy, but could be viewed as a dynamic tools of enquiry, necessary but always subjected to rigorous examination.

6. References

1. Backhouse RE. The puzzle of modern economics: Science or ideology? Cambridge University Press, 2010.
2. Bickley SJ, Macintyre A, Torgler B. Artificial intelligence and big data in sustainable entrepreneurship. Journal of Economic Surveys, Feb 2025; 39(1):103-145.
3. Bohlmann JD, Calantone RJ, Zhao M. The effects of market network heterogeneity on innovation diffusion: An agent-based modeling approach. J Prod Innov Manag. 2010; 27(5):741-760.
4. Chakraborty T, Chakraborty AK, Biswas M, Banerjee S, Bhattacharya S. Unemployment rate forecasting: A hybrid approach. Comput Econ. 2021; 57(1):183-201.
5. Cobb CW, Douglas PH. A theory of production. Am Econ Rev. 1928; 18(1):139-165.
6. Colander D, Howitt P, Kirman A, Leijonhufvud A, Mehrling P. Beyond DSGE models: Toward an empirically based macroeconomics. Am Econ Rev. 2008; 98(2):236-240. Doi: 10.1257/aer.98.2.236
7. Coyle D. The Soulful Science: What Economists Really do and why it Matters. Princeton (NJ): Princeton University Press, 2010.
8. Da Costa NC, French S. Science and Partial Truth: A Unitary Approach to Models and Scientific Reasoning. Oxford: Oxford University Press, 2003.
9. Dada E, Eyeregba M, Mokogwu CH, Olorunyomi TD. Advanced economic modeling for sustainable development and policy innovation in Nigeria. J Econ Policy Innov. 2024; 12(2):45-60.
10. Debreu G. The mathematization of economic theory. Am Econ Rev. 1991; 81(1):1-7.
11. Drakopoulos SA. Economic crisis, economic methodology and the scientific ideal of physics. J Philos Econ. 2016; 10(Articles). Doi: 10.46298/jpe.10694
12. Driscoll JC, Holden S. Behavioral economics and macroeconomic models. J Macroecon. 2014; 41:133-147. Doi: 10.1016/j.jmacro.2014.05.004
13. Dufour JM. Identification, weak instruments, and statistical inference in econometrics. Can J Econ. 2003; 36(4):767-808.
14. Dutt D, Alves C, Kesar S, Kvangraven IH. Decolonizing Economics: An Introduction. Hoboken (NJ): John Wiley & Sons, 2025.
15. Elragal A, Klischewski R. Theory-driven or process-driven prediction? Epistemological challenges of big data analytics. J Big Data. 2017; 4(1):19.
16. Friedman M. Essays in Positive Economics. Chicago (IL): University of Chicago Press, 1953.
17. Gallegati M. The crisis of economics. In: Complex Agent-Based Models. Cham: Springer International Publishing, 2018, 17-36.
18. Gallegati M. Complex Agent-Based Models. Cham: Springer International Publishing, 2018.
19. Gigerenzer G. Adaptive Thinking: Rationality in the Real World. Oxford: Oxford University Press, 2000.
20. Gilboa I, Postlewaite A, Samuelson L, Schmeidler D. Economic models as analogies. Econ J. 2014; 124(578):F513-F533. Doi: 10.1111/ecoj.12128
21. Gomme P, Rupert P. Theory, measurement and calibration of macroeconomic models. J Monet Econ. 2007; 54(2):460-497. Doi: 10.1016/j.jmoneco.2005.09.005
22. Gräbner-Radkowitsch C, Kapeller J. The micro-macro link in heterodox economics. Ifso Working Paper, 2024.
23. Haldane AG, Turrell AE. Drawing on different disciplines: Macroeconomic agent-based models. J Evol Econ. 2019; 29(1):39-66. Doi: 10.1007/s00191-018-0557-5
24. Hardt Ł. Between isolations and constructions: Economic models as believable worlds. In: Economics Without Laws: Towards a New Philosophy of Economics. Cham: Springer International Publishing, 2017, 133-168.
25. Hausman DM. Essays on Philosophy and Economic Methodology. Cambridge: Cambridge University Press, 1992.
26. Hendry DF, Mizon GE. Improving the teaching of econometrics. Cogent Econ Finance. 2016; 4(1):1170096. Doi: 10.1080/23322039.2016.1170096
27. Hicks J. IS-LM: An explanation. J Post Keynes Econ. 1980; 3(2):139-154. Doi: 10.1080/01603477.1980.11489209
28. Lawani A. Critical realism: What you should know and how to apply it. Qual Res J. 2021; 21(3):320-333.
29. Lawson T. Mathematical modelling and ideology in the economics academy: Competing explanations of the failings of the modern discipline? Econ Thought. 2012; 1(1):1-20.
30. Lawson T. The Nature of Social Reality: Issues in Social Ontology. London: Routledge, 2019.
31. Lehtinen A. Core models in macroeconomics. In: A Modern Guide to Philosophy of Economics. Cheltenham: Edward Elgar Publishing, 2021, 254-283. Doi: 10.4337/9781788974462.00017
32. Lucas RE. Econometric policy evaluation: A critique. Carnegie-Rochester Conf Ser Public Policy. 1976; 1:19-46. Doi: 10.1016/S0167-2231(76)80003-6

33. Marchionatti R, Sella L. Is neo-Walrasian macroeconom(etr)ics a dead end? An assessment of recent criticisms of DSGE models. J Post Keynes Econ. 2017; 40(4):441-469. Doi: 10.1080/01603477.2017.1319250
34. Moosa I. The mathematization of economics: Useful, inevitable, indispensable or simply extravaganza. Manag Econ Res J. 2021; 7(1). Doi: 10.18639/MERJ.2021.9900037
35. Morgan MS, Knuuttila T. Models and modelling in economics. In: Philosophy of Economics. Vol. 13. Amsterdam: Elsevier, 2012, 49-87. Doi: 10.1016/B978-0-444-51676-3.50003-8
36. Moscati I. Behavioural and heuristic models are as-if models too - and that's ok. Econ Philos. 2024; 40(2):279-309.
37. Mowery DC. Economic theory and government technology policy. Policy Sci. 1983; 16(1):27-43.
38. Nevo A, Whinston MD. Taking the dogma out of econometrics: Structural modeling and credible inference. J Econ Perspect. 2010; 24(2):69-82. Doi: 10.1257/jep.24.2.69
39. Pratten S, Davis JB, Marciano A, Runde J. The conflict between formalism and realisticness in modern economics: The case of the new institutional economics. In: The Elgar Companion to Economics and Philosophy. Cheltenham: Edward Elgar, 2004, 339-363.
40. Rappaport S. Abstraction and unrealistic assumptions in economics. J Econ Methodol. 1996; 3(2):215-236.
41. Renze YU. Critical Analysis of Increasingly Mathematical Economics in the Modern Society. Management, Jul 2024; 12(4):248-245. Doi: 10.17265/2328-2185/2024.04.005
42. Romer PM. Endogenous technological change. Journal of Political Economy. 1990; 98(5 Pt 2):S71-S102.
43. Ross D. Mäki's realism and the scope of economics. In: Economics for Real. London: Routledge, 2013, 181-202.
44. Sargent TJ. Dynamic Macroeconomic Theory. Cambridge (MA): Harvard University Press, 2009.
45. Sargent TJ, Vilmunen J, editors. Macroeconomics at the Service of Public Policy. Oxford: Oxford University Press, 2013.
46. Scott S. Mathematics is the lantern: Vito Volterra, Léon Walras, and Irving Fisher on the mathematization of economics. Journal of the History of Economic Thought. 2018; 40(4):513-537. Doi: 10.1017/S1053837217000670
47. Sermpinis G, Stasinakis C, Theofilatos K, Karathanasopoulos A. Inflation and unemployment forecasting with genetic support vector regression. Journal of Forecasting. 2014; 33(6):471-487.
48. Sredojević D, Cvetanović S, Bošković G. Technological changes in economic growth theory: Neoclassical, endogenous, and evolutionary-institutional approach. Economic Themes. 2016; 54(2):177-194. Doi: 10.1515/ethemes-2016-0009
49. Stiglitz JE. Where modern macroeconomics went wrong. Oxford Review of Economic Policy. 2018; 34(1-2):70-106.
50. Sugden R. Credible worlds: The status of theoretical models in economics. Journal of Economic Methodology. 2000; 7(1):1-31. Doi: 10.1080/135017800362220
51. Sugden R. Credible worlds, capacities and mechanisms. Erkenntnis. 2009; 70(1):3-27. Doi: 10.1007/s10670-008-9134-x
52. Taylor L, Von Arnim R. Modelling the impact of trade liberalisation: A critique of computable general equilibrium models. Oxford: Oxfam, 2007.
53. Todd J. Realistic assumptions in economic models. Hofstra Law Review. 2018; 47:231-256.
54. Van Zijp R, Visser H. Mathematical formalization and the domain of economics: The case of Hayek and new classical economics. In: Hayek, Co-Ordination and Evolution. London: Routledge, 2002, 67-93.
55. Vanni T, Karnon J, Madan J, White RG, Edmunds WJ, Foss AM, *et al*. Calibrating models in economic evaluation: A seven-step approach. Pharmacoeconomics. 2011; 29(1):35-49. Doi: 10.2165/11584600-000000000-00000
56. Verreault-Julien P. Non-causal understanding with economic models: The case of general equilibrium. Journal of Economic Methodology. 2017; 24(3):297-317.
57. Weintraub ER. Will economics ever have a past again? History of Political Economy. 2002; 34(5):1-14.