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FALSIFICATIONISM AND RESEARCH PROGRAMMES: IMPACT OF POPPER AND LAKATOS ON ECONOMIC METHODOLOGY

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Abstract

In this paper, I set out to critically review the impact of Popperian falsificationism and Lakatosian methodology of scientific research programmes [subsequently, MSRP] on economic methodology and philosophy of economics. The central thesis I maintain is that neither Popper's falsificationism nor Lakatos' MSRP offers [philosophy of] economics a proper condition for the reception or rejection of economic theories. With this achieved, I highlight some implications and caveats of this argument by way of conclusion.

Keywords: Falsificationism, Methodology of scientific research programmes, Economic methodology, Economic theories; Empirical criticism; Empirical content

Introduction

Studies in economic methodology reveal the influence of Popperian falsificationism as a leading methodology. Lakatosian methodology which also exerts a fairly significant share and pull of sway, is an indirect influence of Popperian philosophy, owing to the striking impression Popper's philosophy has on Lakatos'. To this claim, it must be conceded that a fair textual oeuvre has been developed

around the interrogation of Lakatos' Methodology of Scientific Research Programmes (afterwards, MSRP) and its applicability to economics and its [i.e., economics'] methodology, as well as how it profits for a philosophical second-order inspection of economics.[1] Therefore, I construe the general object of my paper as critically reviewing the imports of economic methodology offered by Popper's philosophy—directly (falsificationism) and indirectly (Lakatos' MSRP).

Noting however, the vastness of the field designated by 'indirect Popperian influence', I exclude any explicit discussion of topics that do not principally concern the aforementioned topics—such as neo-institutionalist economics; should any further indirectly Popperian influenced topic be raised, it would be an implicit discussion on the 'general standards' for economic theory choice which influence economic theories. I therefore consider, from a philosophical parlance, economic methodology. My consideration is 'economic' given that I restrict myself only to the district of economics and, this consideration is concerned with 'methodology' only to the extent that I focus on matters of theory choice and appraisal. Similarly, my consideration is philosophical to the extent that it studies economics from a second-order vantage point of study that is typically philosophical. On this note, I refrain from engaging questions of whether or not 'economic methodology' is worthy of pursuit.

In advancing my argument, I structure the entire progression in three moments which exclude this introduction. In the first moment, I shall discuss Popper's falsificationist methodology and highlight its problems. In the second, I examine Lakatos' MSRP and unearth its Popperian roots. By way of conclusion, for the third, I examine the implications and caveats of my argument, maintaining that neither Popper's falsificationism nor Lakatos' MSRP offers [philosophy of] economics a proper condition for the reception or rejection of economic theories.

Popper's Falsificationist Methodology and Its Problems

In this section, my focus is on an exposition and modestly critical assessment of Popper's falsificationism as an economic methodology. Karl Raimund Popper (1902-1994), a Viennese born[2] philosopher, is perhaps renowned for his widely-recognized text, *Logik der Forschung* (1934)[3] where he heavily criticized psychologism, naturalism, inductivism (which he 'delusively' dissolved),[4] and logical positivism. In the same text, he proposed his concept of 'potential falsifiability' as the criterion for the demarcation between science and pseudo-science. This falsificationist approach to the philosophy of science (of which the philosophy of economics is a subset member) is taken to be Popper's signature in the philosophical cairn. It is representational of Popper's outlook towards the growth of scientific knowledge.

Two theses inform the character of falsificationism: (A) [a/the] demarcation thesis; and (B) [a/the] methodological thesis. (A) refers to Popper's theorization of a falsifiability principle as the criterion for demarcating between science and pseudo-science. (B) depicts how science should operate—i.e., how what is 'scientific', as opposed to what is 'pseudo-scientific', should be practiced in light of the falsifiability principle. For a theory to be 'scientific' [which is the concern of (A)], it must be at least potentially falsifiable by some empirical observation;[5] there must be at least, one empirical basic statement that clashes with the theory.[6]

Potential falsifiability, as Popper gives it, is a logical relationship between any theory T and a basic statement β. The falsifiability principle only needs the logical possibility that T be falsifiable and not necessarily the actuation of such a possibility—i.e., the said falsification need not have been attempted.[7] Interestingly, unlike in the philosophy of science which is replete with a variety of criteria, demarcation is seldom a dispute in economics.[8] In the stead of theory, methodology is of more relevance to economics; practicalities more useful than mere

logical *possibilia*. Thus, if Popper's methodology is to attract considerable economic attention, it requires not just logical, but practical falsifiability of theories.

Resulting from the foregoing, it is possible to construct the structure of a falsificationist scientific practice. There is first, a scientific problem situation that the scientist is to investigate; from this situation in need of scientific explanation, the scientist offers a bold conjecture with the aim of presenting a way out. After the bold conjecture is made, it is subjected to severe testing by making critical comparison with [its] least likely consequences, using the pertinent empirical facts. We can say that Popper's 'severe test' argument [STA] is essentially the following:

STA = *the severity of a test* T *is directly proportional to the ostensible unlikely possibilities of the consequence* ā, *that is being tested.*

Finally, should the implications of *T* be inconsistent with the evidence—i.e., the scientific problem situation and the consequences—the conjecture is ipso facto, falsified and needs replacement by a new conjecture which would not be relatively 'ad hoc' to the original conjecture—i.e., the new conjecture must not be fabricated for the sake of avoiding empirical anomaly.[9] If the theory survives falsification, then it is considered corroborated and granted provisional acceptance.

With an understanding of Popper's fallibilism,[10] the status of provisional acceptance spoken of above, is not fleeting but rather, perpetual. This falsificationist approach explicated above does not, for Popper, give rise to 'true theories' but only theories that are survivors of rigorous severe testing. There are indeed, quite a number of reasons why falsificationism is a desirable methodology; however, it is seldom a practical in economics and there are quite a number of texts that recent methodological commentators have compiled in support of this view. Also, M. Blaug in his chapter contribution to *Method and Appraisal in*

Economics (1976), already argued that falsificationism is a 'normative ideal'.[11]

The question of whether falsificationism *has* been practiced is not the subject of debate among proponents and opponents of falsificationism; it is rather, whether or not falsificationism should be practiced.[12] Should economics and its meta-discipline, philosophy of economics, attempt to practice falsificationism (though it has failed, hitherto, to do so)?[13] Would the discipline and its aforementioned 'second-order' knowledge perspective, be significantly enhanced by a thorough falsificationist practice? Given the details of Popper's falsificationism and its imports for economic methodology, I shall discuss some criticisms of falsificationism explicitly as an economic methodology. Three criticisms which I consider fitting for discussion include: (1) the Quine-Duhem Problem; (2) the Verisimilitude Problem; and, (3) the 'Progress Theory' Problem.

The Quine-Duhem Problem

The Quine-Duhem Problem[14] (sometimes called the Duhem-Quine Problem or the Duhemian Problem) presents a significant challenge in the philosophy of science and scientific methodology, and an equally noteworthy difficulty in the [philosophy of] economics. To begin with, the Quine-Duhem problem is primarily an epistemic thesis about the relationship between evidence and theory. As applied in the philosophy of economics and economic methodology, the convolution of human behaviour requires the use of several initial conditions and rudimentary assumptions. Pertinent to economics, some of these may be false [such as the infinite divisibility of commodities], logically unfalsifiable [for instance, the assumptions of eventually diminishing returns] and some may be logically falsifiable but not practically falsifiable, for example, the completeness assumption in consumer choice theory.[15] The absence of a suitable testing controlled environment poses as a

difficulty for the experimentation of the aforementioned assumptions and restrictions.[16]

There are many questions [and subsequently, many answers as well as many points of dissension as regards the answers] concerning the empirical basis in economics. In this regard, it is arguable, on grounds of empirical facts, that a certain observation was/is not what it was/is thought to be. While Popperian philosophy takes it to be a fundament that the empirical basis need not be incorrigible, a widely accepted convention on the subject of the empirical basis is essential;[17] however, these are sometimes unavailable.

Apart from the aforementioned problems, a third lurks. This is the possibility of 'feedback effects'[18] from the social sciences which may not be compeered in the physical sciences. In this case, the very test of *T* may modify the initial conditions for the test such that the previously veracious conditions are no longer true—or better put, no longer 'the same'—after the test.[19]

The Verisimilitude Problem

The 'admitted failure'[20] of Popper in developing a satisfactory 'interpretative framework' of verisimilitude[21] poses as a vital challenge for a falsificationist economic methodology.[22] Popper advances verisimilitude as a bid to reconcile falsificationism and scientific realism. I may add some very terse remarks about the two parties Popper sought to reconcile via verisimilitude. Scientific realism, apart from holding the truth and ultimacy of the contents of our perceptual external world, aims at providing true theories that represent and interpret the nature of reality, thus aiding possible interventions. Falsificationism is rather particular in its botheration. It is concerned with scientific theories. Falsificationism prescribes a formula for our choice of scientific theories based on their corroborational success achieved by surviving severe tests of the model of STA. If the falsificationist methodology is to be taken to fulfil the realist objectives of science,

corroborated theories should be able to demonstrate their proximity to the truth—truth-proximity or, 'veripropinquity'[23] (Popper's goal for verisimilitude).[24]

Verisimilitude is beneficial to Popper's philosophy in at least two ways. First, it provides an epistemic justification for falsificationism as in its absence (i.e., verisimilitude's), it can be argued that Popper suffers for want of philosophical justification[25] for his recommendations on theory choice. Secondly, verisimilitude offers guidelines for choosing the paramount theory in cases of clash as it suggests the directive for determining the more verisimilar theory among cases of clash. This is therefore, a practical benefit. Of the two benefits, the latter appears more relevant to philosophy of economics and economic methodology because philosophers and economists are constantly faced with making a choice between falsified theories or, between a bold one and a modestly corroborated one.[26]

In remarking about verisimilitude, a central idea must be conceded; it is the following. If verisimilitude was successful and may well be included to the norms of falsificationism—as defense for the norms themselves and as an aid in arriving at the practical decisions of theory choice—then falsificationism could be said to have a significant role in economic theory choice. The 'verisimilitude' of the conclusion depends on the 'truth' of the antecedent of the hypothetically expressed premise. In the absence of such a link between severe experimentation and verisimilitude, the value of falsificationism is undermined in light of the pursuit of science's realist aim.

The Progress Theory Problem

Popper's 'Progress Theory' is basically the following: if a theory T_o is to constitute 'progress' over a preceding theory $T\mu$, T_o must be (i) 'independently investigable'; (ii) possess 'excess empirical content'; and (iii) predict 'novel facts'.[27] These requirements Popper specifies for progressive theory development are rarely

considered 'economically correct' and unsuitable. There is an observable significant disparity between Popper's definition of progress and what is actually conceived in economics. In economics, the concern is in discovering fresh explanations for non-novel facts and clarifying them using less theoretical restrictions.[28] The descriptive and normative composition of 'progress' in economic theory is a rather compound and ongoing question; where the unsuitability of Popper's progress comes in is that his provisions are very strict as compared to the economic impulse of justifying non-novel (i.e., already-known) with lesser restrictions. Thus, to answer the question of progress, any theory that attempts to offer us a set of criteria as a solution must be non-Popperian in that it has to avoid the rigidity of strict Popperian falsificationism.

By and large, I remark that falsificationism fails to deliver an appropriate set of criteria for economics and its philosophical meta-disciplinal perspective. Popper offers us a very rigid edifice that threatens to demolish the existent collection of economic theory, leaving economists and philosophers in a very awkward position—all without assurance that this awkward 'original position' would help us realize more verisimilar theories than the presently available. My general evaluation of Popper's falsificationism as an economic methodology scores in the negative. With this, the tenor is set to review Lakatos' MSRP.

Lakatos' MSRP and Its Popperian Roots

In this section, I shall provide a similar analysis to that of the preceding section. A modest but critical analysis shall be made of the thoughts of Imre Lakatos regarding economic methodology. I shall begin by providing relatively satisfactory details of Lakatos' economic thoughts; subsequently, I shall highlight the impact of his MSRP and where his [i.e., Lakatos'] failures trace to Popper's falsificationism.

Born Imre Avrum Lipsitz (then changed surname to Molnar),[29] Imre Lakatos (1922-1974) was a Hungarian born philosopher of science and mathematics.[30] Together with Alan Musgrave, Lakatos [co-]edited the famous *Criticism and the Growth of Knowledge* (1970), the *Proceedings of the International Colloquium in the Philosophy of Science*, 1965. Lakatos enjoyed a rather early recognition among practitioners in the province of the philosophy of science, since his early publications in the 1970s[31] came on board. Similarly, among practitioners of economics and the philosophy of economics, Lakatos enjoys a certain prestige—arguably owing to the 1974 Napoleon Colloquium on Research Programmes in Physics and Economics.[32]

Lakatos' system, I argue, is a system in its own right in the sense that one can dare to speak of a Lakatosian thought in the same manner as of a Kuhnian thought (i.e., 'normal science') or a Popperian one (falsificationism). Hence, Lakatos' MSRP is a thought-system. Just as no philosophy emerges without a context or influence, Lakatos' MSRP owes its form to some certain influences. In this paper, though I recognize the significant impact historians of science [such as T. S. Kuhn] played in Lakatos' thought-formation, I pay more attention to its Popperian traditions—its roots in Popper's tradition of the philosophy of science.

As a singular thought-system in its own right, the MSRP is Lakatos' articulation of his view on the practice and appraisal of science and scientific practice. For Lakatos, scientific appraisal has as its fundament, the 'research programme', instead of the scientific theory. Lakatos describes the scientific research programme as comprising of a hard core [i.e., the fundamental defining presuppositions of the programme and its elements] which is perceived as sacrosanct by the practitioners of the programme, and a group of continuously developing auxiliary hypotheses. In this manner, the MSRP divides its methodological procedures in two: the positive heuristics and the negative heuristics. The positive

heuristic instructs the practitioner which paths of research to pursue and the negative that steers her clear from the paths of research to avoid. All tests of the programme are necessarily directed at the chunk of auxiliary hypotheses which come to form a protective belt around the programme's hard core.

Thus, the research programme is an ensemble involving a hard core, positive and negative heuristics, and a protective belt. While acceptance of and guidance by the hardcore is necessary for participation in the programme, the major activity of the programme transpires in the protective belt through the mutual contact of the hard core, heuristics and the programme's empirical record. Thus, the assessment of a research programme is based on the theoretical and empirical goings-on in the protective belt of the programme.[33] The programme is said to record theoretical progress if each change recorded in its protective belt predicts novel facts.[34] The empirical progress of the programme depends on the corroboration of the facts [i.e., the empirical content] of the programme.[35] Similarly, Lakatos considers heuristic progress as change consistent with the hard core. Thus, progress for Lakatos—theoretical and empirical—is fundamentally assumed to be consistent with heuristic progress.[36]

The Popper-Lakatos Link: Concords and Digressions

There are a number of ways discernible that prove the Popperian ancestry of the Lakatosian MSRP. Here, I mention the description of empirical content and new facts. The common characterization Lakatos and Popper give to the empirical content of any T is that it is "the set of its potential falsifiers: the set of those observational propositions which may disprove it".[37] Conversely, there are points of dissension between Popper and Lakatos. I list a number of them herein.

I hold the belief that the most evident of these is the exemption from empirical criticism that Lakatos grants to the hard core. This is diametrically opposed to Popper's method of bold

conjecture and severe test. Secondly, on the corroboration-falsification debate, Lakatos appears to have an irreverent [dis]regard for the place of falsification in science. Rather, Lakatos holds that progress proceeds from corroboration rather than falsification of novel facts. However, though Lakatos takes empirical progress as proceeding from corroboration instead of falsification, his account of the relationship between the both is essentially falsificationist.[38]

Being significantly influenced by historians of science, Lakatos employs a meta-methodology that is history-sensitive: one wherein the history of science is the key factor in the appraisal of methodological suggestions.[39] Quite the reverse, Popper takes methodology to be purely normative and excludes the aid of the history of science in the appraisal of methodologies.

The points of dissension between Popper and Lakatos represent the friction between falsificationism and the research programme of economic practice. Economics operates with some fundamental hard cores that are invulnerable to the attack of empirical criticism[40] and these define alternative research programmes in economics. As such, economists are likely to support Lakatos in his positions over Popper. Similarly, on the corroboration versus falsification quandary, Lakatos is likely to be favoured over Popper. Falsificationism has rarely—if ever—practiced in economics; any attempt to activate its practice would be leading economics to its extinction.[41]

Lastly, practitioners in the economic paradigm would likely support Lakatos' consideration of the role of the history of science in the appraisal of methodological suggestions. I suspect that we humans are naturally keen on our history and we hold dear our available historical narratives. Similarly, each discipline treasures its historical journey and is likely not to discard it so easily. Though the nature of the relationship between the history and practice of a discipline—in this case, economics—is debatable, the relationship is not usually altogether dismissed.

However, there is a certain identifiable tendency among economists and their philosophical compeers to analyze economic theories by way of a compartmentalization that is assumed to make recourse to the Lakatosian constituents of hard core and heuristics. Nonetheless, this attempt often ends up to evaluate—even though such work usually ends up in a Lakatosian manner of 'progress' assessment—because of the infidelity or rather, diluted and carefree usage of the Lakatosian terminologies. As such, there is a very ostensible discrepancy between what recent economists intend by hard core, heuristics, and novel facts and what Lakatos expresses.[42] I agree with D. W. Hands who excogitates that this is because of Lakatos' Popperian heritage and economics' deviation from such paths.[43]

Arguably, Popper's work is less suited for the appraisal of economic methodology and theory than that of Lakatos. Lakatos' history-sensitive meta-method has helped realize significant success/progress in historical studies, encouraging further survey of such crucial questions as the relationship between econometrics and economic theory.[44] Not regarding these points, the MSRP fails to account for a suitable criterion for the reception or rejection of economic theories; this reflects in the acceptance of Popper's philosophy by Lakatos—and this admission of Popperian aspects failed to suitably alter the Popperian dimensions to fit the Lakatosian outfit of the MSRP.[45] Thus, with very significant defects, neither falsificationism nor the methodology of scientific research programmes provides an appropriate model for the appraisal of economic theories.

Conclusion: Implications and Caveats

In the final analysis, it seems that Popper's economic methodology must be accorded low marks. I consider that Popper's falsificationism is unfitted to economics as regards providing it with a suitable criterion for the reception or rejection of theories. This unsuitability affects the whole fitting between MSRP and

economics. Thus, in the long run, Popper's and Lakatos' methodology do not provide the best criterion for economic practice. Nonetheless, I must add some disclaimers. Notwithstanding the failures, the testing [of the sort of the STA] that Popper's falsificationism proposes is significant—even in economics. Similarly, we should not harshly appraise Lakatos' work. Lakatos' MSRP has also helped in effectuating a more history-sensitive economics. This may not have obtained at the juncture of temporal progression that it did, if Lakatos was not on board.

Narrowly defined, the task of my paper, its relevance and central thesis maintained is that neither Popper's falsificationism nor Lakatos' MSRP offers [philosophy of] economics a proper condition for the reception or rejection of economic theories. Despite that I argue for a negative appraisal of the Popperian economic methodological tradition—specifically Falsificationism and the Methodology of Scientific Research Programmes—I do not argue for the complete cashiering of this Popperian tradition as I opine that there are some elements worth learning from this tradition: an evaluation of testing (from falsificationism) and a historically-sensitive meta-methodology (MSRP).

Notes and References

[1] D. W. Hands, "Falsification, Situational Analysis and Scientific Research Programmes: the Popperian Tradition in Economic Methodology", in *Post-Popperian Methodology of Economics*, ed. N. de Marchi (Boston: Kluwer, 1992), 84.

[2] Then, Vienna was Austria-Hungary.

[3] The English translation, *The Logic of Scientific Discovery* only appeared in 1959.

[4] Popper claimed that we were better off without induction but continuously lived his life on the basis of induction.

[5] Popper believes observation is in itself, theory-laden, where 'theory' as Joseph T. Ekong explains, is taken to be an "interpretative framework" or, an "explanatory grid" that is well verbalized.

[6] The concept of 'basic statement' is introduced in the fifth chapter of *The Logic of Scientific Discovery*. A laudable summary is contained in: J. Watkins, *Science and Scepticism* (New Jersey: Princeton University Press, 1984), 247-54.

[7] Scientific theories are not of their own accord, logically falsifiable. Rather, scientific theories along with copious auxiliary hypotheses may form logically falsifiable test systems.

[8] If it were to be a problematized topic, what do we need to demarcate and from what? Between economic theory and pseudo-economic theory? Between economic methodology and pseudo-economic methodology?

[9] D. W. Hands discusses a number of 'ad hoc-ness' manifest in Popperian philosophy. The kind which is considered in this paper, modification solely for avoidance of falsification, is tagged 'ad hoc 1'. Popper's view of 'independent testability' was developed in order to avoid ad hoc 1. There is another kind of ad hoc-ness; a theoretical modification is ad hoc2 if some of the independently testable implications actually get corroborated. A third type of ad hoc-ness (ad hoc3-ness) was developed more fully by Lakatos and is equivalent to Lakatosian heuristic progress. For a fuller analysis, consult D. W. Hands, "Popper and Lakatos in Economic Methodology".

[10] Fallibilism is the epistemological thesis that suggests the unfeasibility of a conclusive rational justification for any belief.

[11] M. Blaug, "Kuhn Versus Lakatos, or Paradigms Versus Research Programs in the History of Economics", in *Method and Appraisal in Economics*, ed. S. J. Latsis (Cambridge: Cambridge University Press, 1976), 149-80.

[12] D. Wade Hands, "Popper and Lakatos in Economic Methodology", in *The Philosophy of Economics: An Anthology*, ed. Daniel M. Hausman, 3rd ed. (Cambridge: Cambridge University Press, 2008), 191.

[13] Blaug, "Kuhn Versus Lakatos, or Paradigms Versus Research Programs in the History of Economics", 161.

[14] The Quine-Duhem Problem is a form of the thesis of the underdetermination of theories by empirical evidence. The problem is the inability for individual theoretical claims to be confirmed or falsified, isolated from a bundle of surrounding theses. This inability of experimentally testing scientific claims in

isolation, is because an empirical test itself requires one or more background assumptions.

[15] Hands, "Popper and Lakatos in Economic Methodology", 191.

[16] Hands, 191.

[17] Karl R. Popper, "The Rationality Principle", in *Popper Selections*, ed. D. Miller (Princeton: Princeton University Press, 1983), 357-65.

[18] Hands, "Popper and Lakatos in Economic Methodology", 191.

[19] Hands, 194.

[20] Popper, "The Rationality Principle", xxxv.

[21] Karl R. Popper, *Objective Knowledge: An Evolutionary Approach* (Oxford: Oxford University Press, 1972), 65.

[22] D. W. Hands, "The Problem of Excess Content: Economics, Novelty, and a Long Popperian 'Tale'", in *Appraising Economic Theories*, eds. N. de Marchi and M. Blaug (Aldershot: Edward Elgar, 1991), 58-75.

[23] By this, I intend to demonstrate a nearness to the truth.

[24] Popper, *Objective Knowledge*, 80.

[25] Popper, 22; 80.

[26] Hands, "Popper and Lakatos in Economic Methodology", 195.

[27] D. W. Hands, "Ad hocness in Economics and the Popperian Tradition", in *The Popperian Legacy in Economics and Beyond*, ed. N. de Marchi (Cambridge: Cambridge University Press, 1988), 121-37.

[28] Hands, "Popper and Lakatos in Economic Methodology", 197.

[29] Brendan Larvor, *Lakatos: An Introduction* (Cambridge: Cambridge University Press, 2008), 3.

[30] Gyorg Kampis, L. Kvasz, and Michael Stoltzner, eds., *Appraising Lakatos: Mathematics, Methodology, and the Man* (New York: Springer, 2013), 296.

[31] Imre Lakatos, "History of Science and Its Rational Reconstructions", in *Boston Studies in the Philosophy of Science*, vol. 8, eds. R. C. Buck and R. S. Cohen (Dordrecht: D. Reidel, 1971), 91-136.

[32] S. J. Lastis, ed., *Method and Appraisal in Economics* (Cambridge: Cambridge University Press, 1976), 41.

[33] Hands, "Popper and Lakatos in Economic Methodology", 198.

[34] M. Carrier, "On Novel Facts: A Discussion of Criteria for Non-adhocness in the Methodology of Scientific Research Programmes", in *Zeitschrift fur Allegemeine Wissenschaftstheorie*, 19 (1988): 205-31.

[35] Imre Lakatos, "Falsification and the Methodology of Scientific Research Programmes", in *Criticism and the Growth of Knowledge*, eds. Imre Lakatos and Alan Musgrave (Cambridge: Cambridge University Press, 1970), 118.

[36] Hands, "Popper and Lakatos in Economic Methodology", 201.

[37] Lakatos, "Falsification and the Methodology of Scientific Research Programmes", 98.

[38] J. Pheby, *Methodology and Economics: A Critical Introduction* (London: Macmillan, 2015), 98.

[39] Lakatos, "History of Science and Its Rational Reconstructions", 111.

[40] Hands, "Popper and Lakatos in Economic Methodology".

[41] Lakatos, "Falsification and the Methodology of Scientific Research Programmes", 122.

[42] B. J. Caldwin, *Beyond Positivism: Economic Methodology in the Twentieth Century* (London: Allen & Unwin, 2006).

[43] Hands, "Popper and Lakatos in Economic Methodology", 198.

[44] Pheby, *Methodology and Economics*.

[45] Hands, "Popper and Lakatos in Economic Methodology", 198.

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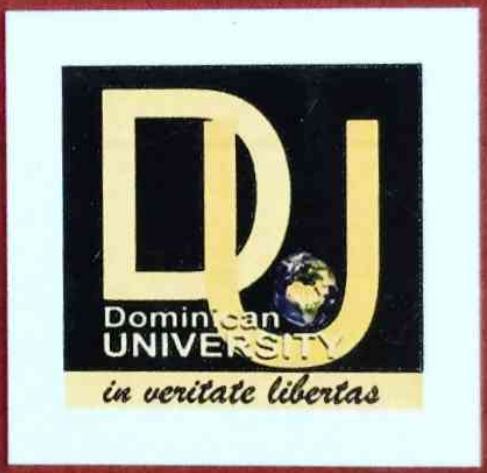

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