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► **To cite this version:**

Mariusz Maziarz. 'Growth in a Time of Debt' as an example of the logical-positivist science. Journal of Philosophical Economics, 2017, Volume X Issue 2 (2), pp.47-64. 10.46298/jpe.10700 . hal-03710722

HAL Id: hal-03710722

<https://hal.science/hal-03710722v1>

Submitted on 30 Jun 2022

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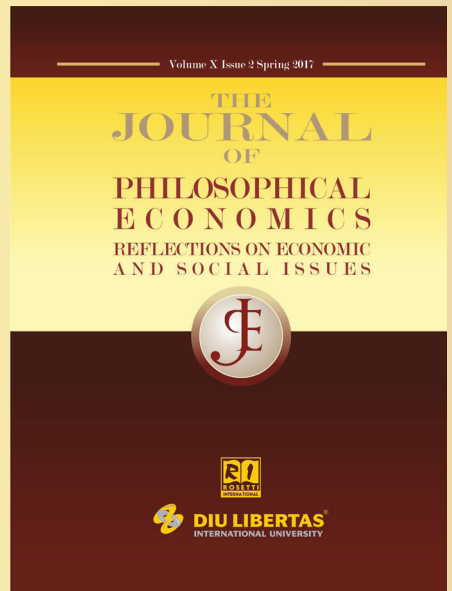
THE JOURNAL OF
PHILOSOPHICAL ECONOMICS:
REFLECTIONS ON ECONOMIC
AND SOCIAL ISSUES

Volume X Issue 2 Spring 2017

ISSN 1843-2298

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*‘Growth in a Time of Debt’ as an
example of the logical-positivist science*

Mariusz Maziarz



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Abstract. The paper addresses the question whether the now-infamous piece of econometric research conducted by Reinhart and Rogoff (2010) that set the threshold hypothesis in the relation between public debt and economic growth was conducted in accordance with the neopositivist doctrine. The article consists of two parts. First, the epistemic advice given by logical positivism is reconstructed and operationalized. Second, the econometric method employed by Reinhart and Rogoff (2010) is analyzed. The answer to the research question is affirmative. 'Growth in a Time of Debt' is a piece of logical-positivist science because (1) the research is data-based and aimed at confirming the results, (2) its authors are committed to the neopositivist theory-observation distinction, (3) its goal is describing an empirical generalization and the result's interpretations suggest that (4) Reinhart and Rogoff (2010) understand causality in a reductionist way, as a constant conjunction.

Keywords: Reinhart-Rogoff, logical positivism, methodology, causality, economics

Received: 26 January 2017

Introduction

The question whether or not economics is a neopositivist science recurs throughout the philosophy-of-economics literature. On the one hand, some methodologists criticize economics for being a discipline too dependent on logical-positivist doctrine, which is currently out of fashion among philosophers of science (Scheuer 2015; 2013; Boland 1991; McCloskey 1989). On the other hand, Hutchison (2000) and Schinekus (2010) accuse economists of not paying enough attention to empirical data and, instead, relying too much on formalized, theoretical models. These critics point out the disadvantages of research practice *from the perspective of logical positivism*. And McCloskey (1998, p. 228) seems to join both groups of critics. Her book claims that economics is 'too neopositivistic a discipline' and accuses economists of being 'too bound to empiricism and constant (big-M) methodology' – to use her own terminology – but in the same text she acknowledges that economists do not conduct their research in line with logical positivism, but only pay lip-service to this doctrine.

These divergent opinions on whether contemporary economics is a neopositivist discipline or not highlight the importance of the philosophy-of-economics research aimed at assessing the descriptive adequacy of competing doctrines. The goal of this article is to address the question 'is logical positivism a descriptively adequate philosophy of science?' by studying the sound research conducted in 2010 by Reinhart and Rogoff (henceforth RR). *Growth in a Time of Debt* is a great candidate for a case-study analysis due to its importance in shaping academic discourse on the relation between public debt and economic growth. Moreover, the analysis influenced the post-crisis public policy and its subsequent criticism. Additionally, the quantitative method employed by RR is comparatively simple, and discussing it from a philosophical perspective does not demand advanced knowledge of econometrics. However, it should be noted that the below-described analysis has restrained from discussing the Reinhart-Rogoff controversy in detail. The problem whether or not Herndon, Ash, and Pollin's (2014) criticism is justified was recently considered by Maziarz (2017), who argued that the *Growth in a Time of Debt* controversy exemplifies the 'emerging contrary result' phenomenon described by Goldfarb (1997; 1995).

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The article consists of two main sections, followed by concluding remarks. First, the doctrine of logical positivism is rationally reconstructed and operationalized in the context of economic research. Second, the method employed by RR is discussed and the philosophical presuppositions underlying it are reconstructed. Finally, *Growth in a Time of Debt* is shown to exemplify the logical-positivist methodology, and general remarks about how resigning from neopositivist presuppositions might help toward a better understanding of economics conclude the considerations.

Logical positivism and economic research

The doctrine of logical positivism was coined and elaborated by groups of philosophically oriented scientists, logicians, and philosophers, originally working in several academic centers in Europe, who immigrated to the United States after the start of World War II. The two most important and popular groups were the Vienna Circle and the Berlin Circle. However, Blaug (1992, p. 17) also listed the Lwow-Warsaw School and the Uppsala School. The list of most notable logical positivists includes Rudolf Carnap, Herbert Feigl, Kurt Gödel, Otto Neurath, Moritz Schlick, Carl Hempel, and Hans Reichenbach (McGrew, Alspecter-Kelly and Allhoff 2009, p. 307-308).

Logical positivist ideas are grounded on one hand in the opposition to the rationalist philosophical systems – exemplified by, for instance, Georg Hegel – and on the other hand, the empiricist presuppositions held by major physicists of that time and August Comte's positivism. It should be noted that those philosophers never created a single, unified philosophical school, but that their philosophical viewpoints constantly evolved and improved. Therefore, the concept of logical positivism as known today is based on simplifications and generalizations. During the last decades of the twentieth century, several historians of the philosophy of science (Friedman, (1999) and Richardson (1988), for instance) attempted to reformulate the popular-in-the-literature interpretation of logical positivism. According to their so-called revisionist interpretation of the traditional viewpoint, neopositivism and Kuhnian views on

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science and incommensurability are not contradictory. On the contrary, Izrik and Grünberg (1995) argued that the viewpoint of logical positivists encountered a problem later known as the Duhem-Quine thesis. In a Duhem-Quine scenario, theories are underdetermined by observation. And a disconfirming observation/experiment falsifies more than the single hypothesis or theory under consideration; it falsifies the whole edifice of knowledge.

However, below, the logical-positivist doctrine is reconstructed in line with the traditional interpretation for two reasons. First, the revisionist interpretation is not widely supported among philosophers of science. For instance, Oliveira (2007) pointed out that Kuhn's opus magnum, *Structure of Scientific Revolutions* was published in a volume edited by Rudolf Carnap (*Encyclopaedia of Unified Science*), a fact that makes it difficult to acknowledge Carnap's support for Kuhn's ideas. Secondly, the philosophers and methodologists interested in economics seem to support the usual understanding of logical positivism (cf. Boumans and Davis 2016, 13-14; McCloskey 1998, 139-155; Hutchison 1938, 3-17).

Detailed descriptions of the logical-positivist doctrine are present in the literature (cf. Ladyman's (2002, p. 151)), therefore, instead of delivering a detailed description thereof, the purpose of this article is simply to address the question whether or not *Growth in a Time of Debt* is a piece of neopositivist science. Several aspects of the doctrine will be highlighted in the reconstruction delivered below: (1) neopositivist views on causation, (2) limiting the knowledge to analytic and synthetic reasoning only, (3), the correspondence definition of truth, (4) the demarcation problem, (5) confirmationism, and (6) views on scientific laws.

Causality in logical positivism

The doctrine of logical positivism, as mentioned above, can be traced back to the development of British empiricism. Especially the neopositivist views concerning causality were inspired by one of the representatives of British empiricism. David Hume (1963, 34-35) believed that causality can be understood in a reductionist way, based on the assumption that it is impossible for humans to experience the relation between cause and effect. Instead, we can only observe

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constant conjunctions of two events. (cf. Maziarz (2015) for a detailed discussion how the concept of Granger-causality emerged from the Humean account.) Also, Ernst Mach's philosophical considerations of the question *what is causality?* can be said to inspire logical positivists (Smith 1989). Due to these inspirations, logical positivists held that causality can be reduced to constant or statistical conjunctions and interpreted as functional and correlational dependencies. The reductionists' approach to causality also inspired their viewpoint on the cause-effect relation and their interpretation of scientific laws (to be explained further).

Analytic and synthetic reasoning

One of the central tenets of the doctrine of logical positivism, one that highlights the empiricist orientation of the movement, is the rejection of metaphysics. Contrary to the neopositivist stance on metaphysics, ontological investigations can be useful in economics. For instance, Grüne-Yanoff (2016) argued that mechanistic evidence, in line with the mechanistic theories of causality, is crucial in corroborating econometric results. The domain of metaphysics was believed to be not only false but meaningless because ontological statements were impossible to either verify or confirm (even in the most liberal approach, which defined confirmability as describing any possible method of confirmation, even a method only theoretically conceivable). Meaningful sentences are, according to the logical-positivist doctrine, divided into two classes: analytic and synthetic statements. The former were defined as an outcome of logical reasoning and tautological reformulations. The latter were based on empirical observations. The movement of logical positivism rejected the concept of a priori statements coined by Immanuel Kant, Gottfried Leibniz, and Baruch Spinoza because they were believed to be falsified by the developments of science, namely Einstein's general theory of relativity (Parrini 1995, p 47). In economics, axiomatic reasoning is instantiated by the assumption of profit maximization of firms in classical microeconomics; but addressing whether or not the aprioristic reasoning is justified exceeds the scope of this article.

The correspondence definition of truth

Epistemically, the neopositivists were committed to the verificationist theory of meaning, which, due to the theoretical developments, was later understood in The Journal of Philosophical Economics X: 2 (2017)

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terms of confirmation and theoretical confirmability. Ontologically, the neopositivists accepted the correspondence definition of truth formalized by a member of Warsaw-Lvov Circle. Alfred Tarski's (1944) concept was based on the reformulated Aristotle's definition: 'To say of what is that it is not, or of what is not that it is, is false, while to say of what is that it is, or of what is not that is not, is true.' If we wished to adapt ourselves to modern philosophical terminology, we could perhaps express this concept by means of the familiar formula: 'The truth of a sentence consists in its agreement with (or correspondence to) reality' (pp. 342-343).

The demarcation problem

Defining truth as mirroring reality in language forced neopositivists to reject metaphysics on the grounds that such theories and views lacked cognitive content: 'in the domain of metaphysics, including all philosophy of value and normative theory, logical analysis yields the negative result that the alleged statements in this domain are entirely meaningless' (Carnap 1959, pp. 60-61). The neopositivists' stance on metaphysics can be exemplified by their views on the central tenet of scientific realism: the philosophy-of-science theory that later became their philosophical successor.

Carnap (1950) dealt with the question of whether or not theoretical entities described by physics exist by re-examining the question. He first divided the term 'existence' into two problems: 'internal' and 'external' existence. Existing internally, for Carnap (1950, p. 21) meant being described by a theory, *to be real in the scientific sense, (...) to be an element of the system*. On the contrary, external existence was the feature discussed by the realist/antirealist-debate participants and that kind of existence, Carnap (1950) argued, was meaningless: 'influenced by ideas of Ludwig Wittgenstein, the Circle rejected both the thesis of the reality of the external world and the thesis of its irreality as pseudo-statements; the same was the case for both the thesis of the reality of universals (abstract entities, in our present terminology) and the nominalistic thesis that they are not real and that their alleged names are not names of anything but merely "flatus vocis"' (p. 34). A similar viewpoint was voiced by Moritz Schlick (1959).

Confirmationism

In contrast to the metaphysical problems that were believed by the neopositivist to be meaningless, meaningful were those sentences that, according to Schlick (1936), could, in principle, at least, be verified. However, considering the fact that the great majority of scientific laws is impossible to conclusively verify, Carnap (1936) argued that the criterion of meaning should be based on the concept of confirmation, instead. Verification of a statement is a process of showing that it is true. However, even a philosophy class example of a scientific law, the law 'all swans are white' is impossible to be verified, because it is in principle impossible to enumeratively induce that there is no black swan. Alternatively, according to the 'confirmationist criterion of meaning', statements are meaningful if it is possible to conceive of a method of confirmation of a sentence, i.e. to describe when a considered sentence will be true (even if, in the philosophy-of-science literature, the term 'verificationist criterion of meaning' remained unchanged). As Carnap (1936, p. 420) put it, 'a definitive and final establishment of truth, then no (synthetic) sentence is ever verifiable, as we shall see. We can only confirm a sentence more and more. (...) we call [a statement] (...) confirmable if we know under what conditions the sentence would be confirmed.'

Carnap (1936) also voiced his developed viewpoint on the process of confirmation: 'How do we find confirmation of a law? If we have observed a great many positive instances and no negative instance, we say that the confirmation is strong. How strong it is and whether the strength can be expressed numerically is still a controversial question in the philosophy of science' (p. 20). This logical process of confirming scientific knowledge is very divergent from the Popperian falsificationism, which is a widespread approach to the philosophy of economics (cf. Blaug 1992; Boland 2016). According to the doctrine coined by Popper (2005), scientists should first construct theories and then attempt to falsify them, resulting in non-verifiable hypotheses. On the contrary, according to logical positivism, empirically oriented scientists (e.g. econometricians) aim at delivering evidence to support a theory/hypothesis, not contradict it.

Scientific laws

The neopositivist viewpoint on the role of laws in the edifice of science evolved. Formerly, scientific laws were believed to offer an economic description of phenomena what was inspired by the empiricist doctrine exemplified by the widely-known physicist, Ernst Mach (1893). However, the twentieth-century logical empiricists redefined the purpose of science and the role of scientific laws. Instead of delivering economic descriptions, scientists should aim at offering explanations, which, according to the deductive-nomological model of explanation, are symmetrical to predictions. In other words, logical positivists believed that the process of explanation and prediction is the same: to predict is to explain *ex ante*, but, oppositely, to explain is to deliver data and laws sufficient for making right predictions (cf. Carnap 1936, pp. 3-8; Hempel 1965, pp. 335-338. Scientific laws are crucial for explanation and prediction according to D-N model of explanation.

The centrality of scientific laws for the doctrine of logical positivism led to the development of philosophical considerations focusing on them. Carnap (1936, pp. 3-4) distinguished between universal and statistical laws. Universal laws should be understood as 'a (...) regularity (...) observed at all times and all places, without exception'. On the contrary, 'instead of asserting that a regularity occurs in all cases, some laws assert that it occurs in only a certain percentage of cases. If the percentage is specified (...) then the statement is called a "statistical law"'. The second distinction is made between empirical and theoretical laws. According to Carnap (1936, p. 5), theoretical laws entail unobservable entities and are characterized by a high degree of abstraction. Many theoretical laws can be found in particle physics or the electromagnetic field theory. On the contrary, empirical laws are observable generalizations between observable phenomena (i.e. not between theoretical entities). The neopositivist philosopher of science exemplified this class of scientific laws with the law of thermal expansion because it is based on many direct observations of physical bodies (e.g. pieces of a metal) and temperature. This example supports the point of view in which empirical laws are not necessarily grounded in unaided observations.

Below, it is argued that that the sound and now infamous article describing cliometric research conducted by Reinhart and Rogoff (2010) is an example of

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research handled in line with the neopositivist doctrine. In detail, the 90%-debt hypothesis coined in *Growth in a Time of Debt* instantiates an empirical law. Certainly, there are theoretical approaches connecting debt and growth and even aimed at justifying a threshold hypothesis (Reinhart, Reinhart and Rogoff 2012), but the theoretical account is not developed enough to enable formulating the debt-threshold level. Additionally, it is argued that the method used in this research shares each of the epistemic elements of the logical-positivist doctrine, which are reconstructed above.

***Growth in a Time of Debt* as a piece of neopositivist science**

Reinhart and Rogoff (2010) are the first cliometricians, or the first econometricians focused on researching economic history with the help of statistical and quantitative methods, who formulated a threshold hypothesis in the relation between public debt and economic growth. Their article *Growth in a Time of Debt* is sound for two reasons. First, the research was widely cited and very influential (both in terms of shaping public policy and the academic world) because its time of publication happened to correlate with enormous debt overhangs caused by the anticyclical policy implemented by most developed countries in response to the start of the 2007/2008 global financial crisis. The importance of the research for shaping anti-crisis policy was highlighted by Krugman (2013), who described the considered piece of econometric modeling as surely the most influential economic analysis of recent years. Second, the research was highly criticized by Herndon, Ash, and Pollin (2014), who discovered the spreadsheet error and accused Reinhart and Rogoff (2010) of other two drawbacks. Since this article's aim is to address the question if *Growth in a Time of Debt* exemplifies neopositivist science, and not to discuss the Reinhart-Rogoff controversy (for the methodological analysis focused on this purpose, cf. Maziarz (2017)), the question whether the criticism is justified is not addressed below. On the contrary, further considerations focus on assessing whether the research described in *Growth in a Time of Debt* was conducted in line with the neopositivist doctrine.

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Causal interpretation

Even though Reinhart and Rogoff (2010) restrained themselves from interpreting the described analysis in causal terms, their finding that public debts (above 90% debt-to-GDP ratio) are related to slower economic growth was later read as causal and ready-to-implement policy advice. It was possibly grounded in Reinhart and Rogoff's (2010, p. 574) considerations of the causes why public debt overhangs arise. The empirical generalization claiming that high levels of public debt harms economic development was interpreted causally in a similar way to Cartwright's (1989) approach to interpreting economic laws. It should be noted that Reinhart and Rogoff (2013a; 2013b) disagreed with the causal interpretation and argued that their research should be considered as a strictly correlational analysis. However, their research can suggest such an interpretation. In detail, Reiss (2013, p. 4) argued that other statements they made lent themselves to causal interpretation: 'In a series of academic papers with Carmen Reinhart we find that very high debt levels of 90% of GDP are a long-term secular drag on economic growth that often lasts for two more decades or more (...) and they certainly regarded the 90 percent threshold an important indicator for policy (e.g. "Our analysis, based on these cases and the 23 others we identify, suggests that the long-term risks of high debt are real").'

Analytic and synthetic reasoning

The division of knowledge between analytic and synthetic reasoning is still widely acclaimed, even if the doctrine of logical positivism lost its influence on shaping current philosophy-of-science discussion (Woleński 2004). Reinhart and Rogoff (2010), employing the econometric, data-based approach to investigating the history of economics, focused on synthetic reasoning. Their research, which is certainly included in mainstream economics, is also, to some degree, exceptional, because mainstream, neoclassical economics are often accused of relying too much on apriorism (cf. the classical text of Sargent and Sims (1977)).

The correspondence definition of truth

Unlike Maziarz (2017), who claimed that the results are constructed and depend on choices concerning research methods (in other words, that the relation between public debt and economic growth depends on employed methods),

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Reinhart and Rogoff (2010), as well as their critics, i.e. Herndon, Ash, and Pollin (2014), are likely to support the correspondence definition of truth. Assuming that two contrary sentences p and $\sim p$ refer to the same reality R , only one of the two sentences can be true. It follows from the law of non-contradiction, one of the three classic laws of thought, according to which two mutually exclusive statements cannot be right at the same time at the same place (Lear 1986, p. 101). In contrast, assuming a constructivist approach where true descriptions depend on methods, this contradiction does not occur. The philosophical presupposition of the correspondence definition of truth – or, (to use a later-developed term) of the 'scientific realism' held by these two teams of cliometricians – is implied by their claim that only one of the two results can be right (Reinhart and Rogoff 2013a; 2013b; Herndon, Ash, and Pollin 2014).

The demarcation problem

As mentioned above, Reinhart and Rogoff (2010) did not consider whether their correlational research could be interpreted in causal terms (even though it was) and, in spite of admitting that the 90%-threshold hypothesis is applicable and should shape economic policy, they did not take sides in the debate about causality. The authors can be suspected of an unvoiced support for the manipulationist account of causality, but their failure to consider this issue is in line with the neopositivist approach to the demarcation problem and meaningful-meaningless division. In a similar vein, Reinhart and Rogoff (2010) did not consider questions about whether their definitions of public debt and economic growth rightly refer to reality, even though 'public debt' can be defined and calculated in different ways (cf. Maziarz 2016). Instead, they treated the variables entailed in their database instrumentalistically. It should be noted as a reminder that according to the logical-positivist doctrine, both theories of causality and problems of 'external' existence are considered to be meaningless (Carnap 1950; Schlick 1959).

The confirmationist approach to the coined hypothesis

One of the easiest-to-see differences between logical positivism and other antirealist philosophy-of-science theories is highlighting confirmationism as a method of justifying statements. For instance, in contrast to Popperian fallibilism, the method advised by the logical positivists of justifying hypotheses

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is distinct. As Carnap (1936, p 420) put it, 'a sentence is ever verifiable, as we shall see. We can only confirm a sentence more and more'. Reinhart and Rogoff (2010) attempted at fulfilling the neopositivist ideal of the knowledge-justification process by setting up statistics for four slightly different databases. Since the results for each of the three sets of country/year observations were similar, the 90%-threshold hypothesis was acknowledged by Reinhart and Rogoff (2010) to be justified. Considering the methods employed by the authors of *Growth in a Time of Debt*, it is clearly visible that they aimed at confirming their hypothesis instead of, for example, falsifying it according to the epistemic advice of fallibilism. They produced empirical generalization from data confirmed by the 90%-debt hypothesis instead of drawing such an implication from the macroeconomic theory and attempting to falsify it. The confirmationist approach shown by Reinhart and Rogoff (2010) is likely the most easy-to-see feature of their research conducted in line with the neopositivist doctrine.

The 90%-threshold hypotheses as an empirical law

However, their approach to establishing the 90%-threshold hypothesis instantiates Reinhart and Rogoff's (2010) commitment to the methodology offered by logical positivism. In order to coin the hypothesis, the American cliometricians observed the empirical dependence, or, to use logical-positivist terminology, empirical regularity between public debt and economic growth. In detail, Reinhart and Rogoff (2010) divided all the country-year observations into four baskets: low debt (below 30%), medium debt (30-60%), high debt (60-90%), and very high debt (over 90%). Subsequently, they calculated weighted average pace of economic growth for each of the four baskets. The choice of averaging scheme was criticized by Herndon, Ash, and Pollin (2014) as one of three drawbacks, because it equated the influence of a single country-year observation with a case like Greece, which was included in the basket of very high debt for 19 years between 1946 and 2009. However, contrary voices indicating that the two methods are justified to a similar degree are present in the literature (cf. Maziarz 2017; Hamilton 2013).

Whatever the result of this dispute will be, Reinhart and Rogoff's (2010) method was generally based on observing the relation between public debt and economic growth and coining the empirical law, stating that the pace of economic growth

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of countries with *public debt over roughly 90 percent of GDP are about one percent lower than otherwise* (p. 573). A counterargument might object that such a method is not observation, since 'public debt' and 'economic growth' are not observables, but rather theoretical constructs or theoretical entities, to use the neopositivist terminology. However, similarly to the above-discussed case of observing the temperature of a metal in physics (which entails the use of a thermometer constructed according to physical theories), these economic theoretical entities can also be included in the former set of the observation/theory distinction.

Concluding remarks

Growth in a Time of Debt can justifiably be said to instantiate neopositivist science. First, even though the causal interpretation of Reinhart and Rogoff's result is sometimes believed to be an exaggeration, by highlighting the importance of the 90%-threshold hypothesis for economic-policy making, the authors are likely to hold the reductionist presupposition on causality, according to which causal phenomena are instantiated by constant regularities. Second, their data-based approach to research fulfils the analytic/synthetic division of knowledge and instantiates the former. Third, their strong disagreement supports the view that only one of the two results can be interpreted as Reinhart and Rogoff's (2010) commitment to the correspondence definition of truth. Fourth, the hypothesis which the American philosophers commit to the neopositivist methodology is further corroborated (or confirmed, to borrow the logical positivist term) by the fact that their research and considerations do not deal with metaphysical questions. The article does not voice an opinion about how causality is understood. In fact, the authors consider their finding in terms of empirical regularity, even though they state that it has direct implications for economic-policy making. Fifth, Reinhart and Rogoff (2010) employ the confirmationist approach to evidence: they attempt to deliver further corroborations. Finally, the 90%-threshold hypothesis instantiates empirical law.

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The Reinhart-Rogoff controversy got a lot of attention both among academic economists and the general public. Its soundness is probably exaggerated, considering Maziarz's (2017) argument, that the influence of the spreadsheet error was minor in comparison to the influence of choosing weighted or unweighted averaging scheme for the results. In contrast, the controversy is not an affair (as the synonymic 'Reinhart-Rogoff affair' states), but rather a normal occurrence in the empirical literature methodological discussion. Nevertheless, considering that the above-mentioned voices criticize economics as a (still) neopositivist science, analysing whether most sound examples of the current economic research are conducted in line with the logical positivist methodology seems to be justified and fruitful.

As Maziarz (2017) indicated, the Reinhart-Rogoff controversy instantiates the 'emerging contrary result' phenomenon (a.k.a. 'emerging recalcitrant result', or ERR phenomenon), which was created by submission/publication and originally described by Robert Goldfarb (1995; 1997). According to the American economic methodologist, econometricians change their opinion on macroeconomic issues because there is an institutional pressure that forces them to look for novel results. It might be hypothesized that a similar phenomenon can be observed also in philosophical investigations, and this hypothesis should be further researched. For instance, the history of interpreting the logical-positivist doctrine seems to reflect the pattern in the literature that is a characteristic feature of the ERR phenomenon caused by the submission/publication bias. First, one viewpoint is established in the literature (the traditional interpretation). Second, there are researchers that question this previously established result (Friedman (1999) and Richardson (1988) are good examples). Third, a new viewpoint (the revisionist interpretation, in this case) is established. Therefore, the question if ERR phenomenon exists also in the philosophical literature should be further researched.

Acknowledgments

The author thankfully acknowledges the support received from the National Science Centre, Poland under grant no. 2015/19/N/HS1.01066. The line of the

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argument was substantially improved due to the comments voiced by Dr Bartosz Scheuer and two anonymous reviewers of *The Journal of Philosophical Economics*.

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