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Neoclassical Economics' Immunisation Strategies Against Behavioural Economics: Popper's Perspective*

Strategie immunizacji ekonomii neoklasycznej przeciwko ekonomii behawioralnej – perspektywa Popperowska

Abstract

Although neoclassical economics faces frequent criticism, it remains the dominant paradigm, largely due to its immunisation strategies that rely on unfalsifiable concepts of utility and rationality. In this paper, I use Karl Popper's philosophy to assess whether these strategies are justified. Firstly, I reconstruct Popper's ideas on immunisation strategies, situational analysis, the rationality principle, and the metaphysical research programme. Next, I examine how neoclassical economics' immunisation strategies counter critiques from behavioural economics. I conclude that neoclassical economics' method does not produce empirical conjectures. I assess and evaluate this finding in relation to the "rationality principle", as it parallels neoclassical economics' optimisation axiom. Furthermore, I explore Popper's relevance in the context of neoclassical economics' recent incorporation of behavioural economics' insights to show that my analysis is not purely historical.

Keywords:
philosophy of science, philosophy of economics, Popper, neoclassical economics, behavioural economics

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Streszczenie

Mimo że ekonomia neoklasyczna nieustannie spotyka się z krytyką, to pozostaje dominującym paradygmatem nauk ekonomicznych. Dzieje się tak głównie ze względu na wykorzystanie strategii immunizacji opartych na niefalsyfikowalnych koncepcjach użyteczności i racjonalności. W niniejszym artykule oceniono, czy użycie teorii filozoficznych Karla Poppera jest uzasadnione. Po pierwsze, zrekonstruowano idee Poppera dotyczące strategii immunizacji, analizy sytuacyjnej, zasady racjonalności i metafizycznego programu badawczego. Po drugie, poddano analizie to, w jaki sposób strategie immunizacji ekonomii neoklasycznej działają w obliczu krytyki ze strony ekonomii behawioralnej. Stwierdzono, że aplikacja metod ekonomii neoklasycznej nie skutkuje nowymi domysłami empirycznymi. Rezultat ten oceniono w odniesieniu do zasady racjonalności – ze względu na jego podobieństwo do aksjomatu optymalizacji ekonomii neoklasycznej. Ponadto w celu ukazania, że analiza ta nie ma charakteru jedynie historycznego, zbadano znaczenie teorii Poppera w kontekście niedawnego włączenia w ramach ekonomii neoklasycznej spostrzeżeń z obszaru ekonomii behawioralnej.

Słowa kluczowe:
filozofia nauki, filozofia ekonomii, Popper, ekonomia neoklasyczna, ekonomia behawioralna

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Introduction

The main premise of this paper is that, despite extensive criticism in recent years, the paradigm of neoclassical economics (NE) has remained largely unchanged. NE is a broad term that has many definitions, so the assertion that it has not evolved may seem contentious. By lack of change, I specifically mean neoclassical economics' core axioms – optimisation, methodological individualism, and equilibrium – not its scope or methods. There is considerable debate over whether NE has actually evolved. Some argue that it has undergone significant transformation [**Colander et al., 2004**; **Colander, 2010**; **Davis, 2006**; **Rodrik, 2015**; **Cedrini, Fontana, 2018**], while others contend that its fundamental axioms remain intact [**Berg, Gigerenzer, 2010**; **Dow, 2012**; **Hodgson, 2012**; **Kapeller, 2013**; **Gräbner, Strunk, 2020**; **Ostapiuk, 2019**; **2021**]. Those in the latter camp suggest that behavioural economics is merely an extension of NE, as it does not challenge neoclassical economics' foundational axioms [**Berg, Gigerenzer, 2010**; **Dow, 2012**]. I recognise that defining NE solely by its axioms may not satisfy all perspectives, and this approach is indeed a simplification. However, it is a defining feature of NE that this paper emphasises.

Moreover, in this paper, I critically examine neoclassical economics' core axioms, focusing specifically on optimisation, analysed through the lenses of behavioural economics and Popper. However, I do not imply that NE is entirely flawed or should be discarded. Rather, my analysis is limited to examining one axiom – optimisation – within the context of ongoing critiques.

I have outlined how I define neoclassical economics and clarified what I mean when I say it has not changed – this forms the premise of this paper. The paper explores why this change has not occurred and examines the implications for NE. In my view, the lack of change is partly due to the immunisation strategies NE uses to sidestep descriptive criticism. To illustrate how these strategies work, I focus on the criticisms from behavioural economics, which have had the most significant impact on NE in recent years. I do not address every critique, but concentrate specifically on the concept of optimisation (rationality with utility maximisation)[1].

This descriptive criticism concludes that people do not behave according to rational choice theory (RCT). The criticism focuses on the weakness of will, bounded rationality, and bounded self-interest [**Thaler, 2015**], targeting two interconnected assumptions of RCT: (1) that people maximise their utility; and (2) that they are rational. Behavioural economists concluded that people do not make the best choices as RCT assumes. I analyse the two main immunisation strategies against the criticism used in NE. First, the concept of utility is not defined and it can mean anything because people always maximise utility by their choices. Second, NE uses instrumental rationality where rationality means optimisation within certain limits (e.g., time, cognitive abilities, and information). Therefore, people always act rationally within some constraints. As a result of immunisation strategies, NE incorporated the criticism from behavioural economics within the framework of rational choice theory without changing the axiom of optimisation.

Many critics focus on neoclassical economics' immunisation strategies. They argue that expanding the notions of utility and rationality makes them mere tautologies [**Sen, 1977**; **Hodgson, 2012a**]. This methodological criticism echoes Popper's falsificationist criterion. The argument against neoclassical economics' concepts of rationality and utility is that they are unfalsifiable, and thus unscientific. Some neoclassical economists deflect this kind of criticism by arguing that using axioms is a methodological choice (e.g., **Lazear, [2000]**).

This is the lay of the land and it is connected with the first part of the paper's title "Neoclassical economics' immunisation strategies against behavioural economics." The second part "Popper's perspective" seems ambiguous. Why use Popper? First, I use him in the context of immunisation strategies. Beyond analysing how NE used them against behavioural economics' criticism, I check if they are justifiable. Many scientists dismiss immunisation strategies and in common perception Popper shared this view. Second, neoclassical economics'

[1] In the paper, I focus on the criticism within economics. However, rational choice theory is criticised by other social sciences, including sociology, psychology, and anthropology (see **Hodgson [2012b]**).

optimisation based on the rationality axioms can be identified with Popper's rationality principle [**Popper, 1945**; **1994**; **1996**; **2005b**; see **Latsis, 1972**; **Hands, 1992**; **Hoover, 2016**].

In general, the critics of neoclassical economics' axiomatic assumptions directly or indirectly refer to Popper's falsificationism. This paper analyses whether this criticism is justified and whether Popper would have agreed. At the outset, it must be stated that we can distinguish two Poppers [**Hands, 1985**], and the methodological criticism against NE is based on the methodology of PopperN (natural science = falsificationism). This methodology does not fully represent Popper's views on social science. Thus, I analyse PopperS (social science = situational analysis). I check if Popper was against all immunisation strategies. Moreover, I analyse Popper's "metaphysical research programme" to check if he dismisses every unfalsifiable element of a theory.

My primary focus is on Popper's method for social science. PopperS proposed situational analysis (SA) and rationality principle (RP), which should work as in natural science (deductive thinking as a vehicle for empirical conjectures). It fits my discussion because SA is similar to the method used in NE (the unfalsifiable RP and focus on environmental constraints). In the literature, there are many ambiguities on how SA and RP work. I analyse the three prominent interpretations of situational analysis (universal; a priori; and methodological). Thanks to this analysis I check if Popper would have perceived neoclassical economics' immunisation strategies as justified. I also use the unorthodox interpretation of rationality principle as a benchmark [**Palacio-Vera, 2019**] to see if Popper would prefer behavioural to neoclassical economics implementation of RP.

The reader may wonder why we need to reanalyse Popper today and she can doubt if Popper is still relevant in economics. There seem to be two essential reasons for questioning Popper's relevance. First, Popper was analysed by methodologists of economics in the 1970–1980s and his influence on economics has fallen since falsificationism was not a useful framework considering economists' real practice [**De Marchi, 1988**]. This criticism is valid, but most criticism focuses on PopperN, not PopperS whose methodology for social sciences is more sophisticated than naïve falsificationism. Second, various methodologists of economics in the 1980s discerned Popper's complicated nature. They analysed PopperS [**Hands, 1985**; **De Marchi, 1988; Caldwell, 1991**] and found his position on social science, immunisation strategies, and unfalsifiable assumptions at best vague. This criticism is also valid. PopperS is often ambiguous or even inconsistent regarding SA and RP. However, it is possible to "rationally reconstruct" [**Lakatos, 1970**] Popper's ideas[2]. My goal is to present the most plausible version of Popper's view on immunisation strategies with situational analysis and rationality principle. Thanks to this analysis, we can assess immunisation strategies and the problem of tautological RP in neoclassical economics. It is essential to understand PopperS; otherwise the criticism against NE will focus on a falsificationist criterion which does not move the discussion forward.

For now, my claim is that I do better than others in interpreting PopperS and analysing the implications for economics. However, my paper provides some novelty. I use my interpretation of PopperS in the context of behavioural economics' criticism of NE. To understand how immunisation strategies and unfalsifiable RP work, I analyse NE in the context of Becker's economic approach as this framework resembles situational analysis. The comparison between Becker's approach and behavioural economics in Popper's context has not been made. This framework of comparison helps us assess if Popper would have seen neoclassical economics' immunisation strategies as justified. This issue has not been addressed satisfactorily due to prevalent misunderstandings of Popper [**Hands, 1985**]. Moreover, I analyse Popper in the context of neoclassical economics' incorporation of behavioural economics' insights in recent years, which leads to some surprising results.

Lastly, I want to underline that this paper is not a mere reconstruction of Popper's position. I analyse Popper to find solutions to current problems plaguing NE. This helps answer the question if immunisation strategies and unfalsifiable RP (optimisation) used by neoclassical economists are justified and if they lead to the improvement of economics. Popper is still useful in NE because their methodologies face the same problems, e.g., when ad hoc assumptions are justified, can we use unfalsifiable assumptions and have a prediction? I provide the answer to these questions, albeit they are tentative.

[2] Historical reconstruction was made by **Thomas [2017]**.

PopperN (natural science)

I start my analysis by briefly introducing PopperN, his position on immunisation strategies, and his influence on economics. For [**Popper, 1959**], the philosophy's original sin is the problem of induction diagnosed by Hume where no amount of confirming observations will prove that theory is universally true. Popper's solution to the problem of induction is to note that just one observation statement can prove a theory to be false. For Popper, even finding thousands of white swans does not prove that all swans are white. We should look for a black swan to disconfirm our theory. Thus, Popper argues that empirical sciences do not depend on inductive methods [**Popper, 1959**: 27]. Instead, theories are tested deductively. This leads Popper to replace logical positivists' verifiability principle with a criterion of falsifiability. As logical positivists, Popper wanted to demarcate between science and pseudoscience. However, he did not accept their meaningful-meaningless dichotomy. Although the demarcation criterion differentiates the scientific from non-scientific theories, some non-scientific statements can be meaningful [**Popper, 1963**: 346–347]. Be as it may, the falsification criterion became a scientist's golden rule.

When a theory is falsifiable and has been tested, there are two possibilities. If the result is positive, the theory is corroborated (not verified because Popper tried to separate himself from positivists). Scientists accept a theory that is corroborated as provisionally true. Being corroborated does not imply being proven true, which is the result of Popper's fallibilism (all knowledge is conjectural). Popper, as a vehement critic of inductive logic, goes further and argues that we should not perceive a theory that has been corroborated thousands of times as more probable than a theory that has never been corroborated [**Popper, 1959**: 264–265]. If the result is negative, the theory is falsified or refuted. The logic is the same as in corroboration. The refutation of a theory does not prove it to be false as it can change in the future.

The general conclusion from PopperN is that scientists should focus on showing if a theory is false because it is impossible to prove that some theory is true. However, Popper did not want his approach to be only a negative endeavour. Thus, later he proposed the concept of verisimilitude by which we compare which theory is closer to the truth. Even if this method did not work [**Miller, 1974**], it indicates that for Popper the aim of science is a "search for truth" [**Popper, 1963**: 311], to which I refer later.

PopperN and immunisation strategies

Now we can move to the paper's main issue: immunisation strategies. PopperN argues that we learn from experience due to the negative evidence (refutation), not from the positive evidence. Falsificationism compels scientists to examine their theories. When falsificationism is applied right, the false theories will be eradicated from science. This is how science should work in theory. However, Popper was aware that in reality scientists protect their cherished theories from refutation by blaming something other than theory. Initially, Popper used the term "conventionalist stratagem" to describe this behaviour, but later switched to "immunising stratagem." He writes: "But when a little later I tentatively introduced the idea of falsifiability … of a theory as a criterion of demarcation, I very soon found that every theory can be immunized … against criticism. If we allow such immunization, then every theory becomes unfalsifiable. Thus we must exclude at least some immunizations." [**Popper, 2005b**: 43]. The problem of "immunising stratagems" is salient for Popper because it refers to his demarcation criterion. For Popper, the theories immunised from refutation should be considered pseudoscience because they are unfalsifiable. The primary cases are Freudianism, Marxism, and Adlerism: "These theories [those of Marx, Freud, Adler] appeared to be able to explain practically everything… whatever happened always confirmed [them]… It was precisely this fact … which in the eyes of their admirers constituted the strongest argument in favour of those theories. It began to dawn on me that this apparent strength was in fact their weakness." [**Popper, 1963**: 46–47]. The fact that these theories are always confirmed is a weakness for Popper because they are tautologies that cannot be falsified. Freud could explain two opposite results by the same theory, e.g., a man pushes a child into the water to drown it. In the second case, a man sacrifices his

life to save a child. Freud easily explains each of these different behaviours by arguing that the first man suffered from repression, whereas the second achieved sublimation [**Popper, 1963**: 47]. The problem with Marxism is the same but differs in detail. Popper argued that Marxism was originally empirically testable. Marx predicted that a communist revolution would happen in the most advanced capitalist economies. However, when Marx's prediction was falsified (a communist revolution occurred in Russia and China), the theory was recast as irrefutable and was immunised against further empirical criticism [**Popper, 1945**: 317–321].

For Popper, the unfalsifiable theories based on immunisation strategies are the opposite of what scientific theories should be. A scientific method should be based on conjectures and refutations. Popper explains that in various places, "our methodological rule… favour [s] theories with the highest possible empirical content" [**Popper, 1959**: 121] and "[a]serious empirical test always consists in the attempt to find a refutation, a counter example" [**Popper, 1963**: 325]. Popper contrasted Marx's and Freud's unfalsifiable theories with Einstein's gravitation theory. He treated it as a paragon of scientific attitude based on falsificationism [**Popper, 1963**: 47]. Einstein, in advance, proposed a test that made a very risky prediction that could be refuted if his prediction was false. Fortunately, Eddington's eclipse observation in 1919 confirmed Einstein's theory.

To conclude, PopperN treats immunisation strategies negatively because they make theories unfalsifiable. For PopperN, scientific approach is based on conjectures and severe tests. His method is contrary to ad hoc behaviour designed to rescue the theory from refutation. For PopperN, "the aim of science is to get explanatory theories which are as little ad hoc as possible: a 'good' theory is not ad hoc, while a 'bad' theory is" [**Popper, 1963**: 81]. Scientists should not use immunisation strategies because they reduce testability, which is essential for PopperN.

PopperS (social science)

PopperN enormously influenced economics in the second part of the 20th century. Many economists treated falsificationism as a paragon of how economics should be done [**Backhouse, 2012**]. However, since the 1980s his influence has fallen [**De Marchi, 1988**]. **Blaug** [**1992**] argued that economists only praised falsificationism but did not practice it. In reality, neoclassical economics is mostly based on unfalsifiable assumptions [**Hands, 1988**]. Moreover, it was argued that NE does not have predictive power [**Rosenberg, 1992**; **Hands, 1984**; **1990**]. In the end, it was concluded that falsificationism was not the right method for economists. Thus, economists looked for answers in Lakatos and Kuhn [**Hands, 2001**]. The criticism of PopperN was also aimed at the role of immunisation strategies. **Caldwell** [**1991**] made three objections against falsificationism in this context. Firstly, falsificationism is not a good strategy because it can lead to the dismissal of good theories. Secondly, nobody presented a good example of using falsificationism regarding the history of economic thought. Thirdly, there are often good reasons for ignoring Popper's prohibitions concerning immunising stratagems within economics.

As we saw, Popper was criticised for falsificationism. The argument was that economists do not follow his prescription and use many unfalsifiable assumptions. However, the criticism was aimed at naïve falsificationism connected with PopperN. PopperS, to whom I now turn, was sophisticated. He knew that scientists do not follow his strict falsification rule, and that they use conventionalist stratagems to save their theories from refutation. PopperS differentiates four different stratagems [**Popper, 2005a**: 60–61]: (1) ad hoc hypotheses; (2) modification of ostensive definitions; (3) doubting the reliability of the experimenter; and (4) doubting the acumen of a theoretician. My paper analyses the two first stratagems because they are essential in the context of neoclassical economics' immunisation strategies.

The first strategy means that scientists add ad hoc hypotheses to save their theory from refutation. For example, when it was found that the planet Uranus had not moved according to Newton's theory, scientists did not consider it as a falsified theory that must be abandoned. Instead, they added an ad hoc hypothesis: an additional planet. The second strategy is the modification of ostensive definitions. Imagine that scientists discover an object orbiting the sun, but not in an elliptical path as described by Kepler's Laws of Planetary Motion. Scientists could save Kepler's theory if this object were not classified as a planet. The same strategy

can be applied to the raven paradox. Finding a white raven would not necessarily falsify the statement that "every raven is black" if scientists chose not to classify this white bird as a raven. I analyse the modification of ostensible definition later in the context of NE. In this section, I focus on the "ad hoc hypothesis" because it was a crucial immunisation strategy for Popper and it shows the relationship between PopperS and PopperN.

PopperN was vehemently against the use of immunisation strategies, as demonstrated in the cases of Freud and Marx. He opposed adding ad hoc hypotheses because doing so often eliminates the empirical challenges that confront theories and make them falsifiable. While PopperN was against ad hoc hypotheses, PopperS did not claim that they are always bad: "I also realized that we must not exclude all immunizations, not even all which introduced ad hoc auxiliary hypotheses. For example the observed motion of Uranus might have been regarded as a falsification of Newton's theory. Instead the auxiliary hypothesis of an outer planet was introduced ad hoc… This turned out to be fortunate; for the auxiliary hypothesis was a testable one… All this shows not only that some degree of dogmatism is fruitful, even in science, but also that logically speaking falsifiability, or testability, cannot be regarded as a very sharp criterion" [**Popper, 2005b**: 43]. PopperS concedes that not all immunisation strategies based on ad hoc hypotheses must be bad. The most striking part is the last sentence where PopperS questioned the sharpness of his falsifiability criterion. What does it mean, and does it imply a dichotomy between PopperS and PopperN? PopperS was not naïve when it comes to falsificationism. He was aware of the Duhem-Quine thesis, which shows that scientists are never sure if they test a chosen hypothesis or some auxiliary hypotheses due to underdetermination and this is why we cannot test a scientific hypothesis in isolation and falsify it [**Popper, 2002**: 322–224]. Moreover, Popper argues that scientists must accept some empirical basis in test situations as given, though it remains subject to revision because the empirical basis is accepted by convention. Last but not least, Popper acknowledged that the empirical basis is theory-impregnated and its content evolves as the underlying theory changes [**Popper, 1983**: xxii–xxiv]. I do not want to be misunderstood here. PopperS still thinks that ad hoc adjustments are unwanted, but not all of them should be eliminated because some develop science, as in Newton's example. What is important for PopperS is to find a method which distinguishes between good and bad immunisation strategies.

PopperS accepts ad hoc hypotheses if they fulfil the requirement of independent testability. This requires a new theory to make testable predictions independent of the predecessor's predictions. For Popper, it means that a new theory has more empirical content. Moreover, a new theory must have falsifiers. If these requirements are fulfilled, a theory will be "better testable than the previous theory" [**Popper, 1963**: 327]. For Popper, independent testability is identified with prediction of novel facts [**Popper, 1963**: 327]. The requirement of independent testability is essential when judging immunisation strategies. This is visible when Popper distinguishes between "ad hoc" and "auxiliary" hypotheses. A "conjecture is ad hoc … if it is introduced … to explain a particular difficulty, but … cannot be tested independently" [**Popper, 1974**: 986]. An auxiliary hypothesis is also introduced to explain some difficulties but can be tested independently [**Popper, 1974**]. To conclude, PopperS was not against all immunisation strategies. They are justified if they can be tested in principle, which can lead to new facts.

Metaphysical research programme

From the beginning, **Popper [1959]** did not dismiss metaphysics. Instead, he argued that it could be meaningful, which set him apart from logical positivists. With time, Popper incorporated metaphysics into his approach, developing what he called the "metaphysical research programme" (MRP). This was a response to critics of falsificationism who claimed that scientists do not adhere to it. Popper introduced and elaborated on the metaphysical research programme in the first volume of "Postscript to the Logic of Scientific Discovery" [**Popper, 1982**]. I analyse the metaphysical research programme because it shows that PopperS accepts, to some extent, unfalsifiable metaphysical assumptions.

Popper called research programmes metaphysical "because they result from general views of the structure of the world…" and used the term research programme "because they incorporate, together with a view of what

the most pressing problems are, a general idea of what a satisfactory solution of these problems would look like." [**Popper, 1982**: 161]. PopperS provides two main reasons for using metaphysical assumptions in theories. The first is heuristic. The unfalsifiable (metaphysical) assumptions serve as an ontological guide that helps solve problems that scientists encounter. Popper writes: "In almost every phase of the development of science we are under the sway of metaphysical— ... untestable – ideas ... They are ... metaphysical research programmes, which remain mostly unconscious in the minds of scientists but shape their judgements" [**Popper, 1982**: 161]. The second reason is historical – the metaphysical and untestable theories with time can develop into testable scientific theories. Popper draws an analogy between the MRP and particles suspended in a fluid, suggesting that metaphysical ideas can evolve into more universal laws. He provides examples of metaphysical concepts that have transformed into scientific theories, such as atomism, the theory of terrestrial motion, the corpuscular theory of light, and the fluid theory of electricity [**Popper, 2005a**: 277–278]. From the historical point of view, metaphysics provides the fertile soil from which scientific theories can spring up [**Agassi, 1975**]. The historical framework of the MRP shows a similarity between Popper and Lakatos, where research programmes contain testable and untestable elements and scientific progress occurs when theory leads to new discoveries.

Unlike logical positivists, Popper did not dismiss metaphysical elements. However, problems arise because the metaphysical research programme contains unfalsifiable elements. So, how to decide between different MRPs and assess metaphysical elements? Popper claims that we can find "a criterion of demarcation within metaphysics, between rationally worthless metaphysical systems, and metaphysical systems that are worth discussing, and worth thinking about" [**Popper, 1982**: 211]. The metaphysical research programme is worth discussing if it can "provoke rational criticism, and to inspire attempts to supersede it by something better" [**Popper, 1982**: 211]. Popper proposes critical rationalism as a way to judge and compare different MRPs. If we analyse the history of science, we observe that critical discussion can improve the MRP. Moreover, the focus on a critical discussion shows that PopperS does not perceive falsificationism as an all-encompassing method for science. Critical rationalism can be enough to distinguish science from pseudoscience: "Scientific theories are distinguished from myths merely in being criticizable, and in being open to modifications in the light of criticism" [**Popper, 1983**: 7]. Popper concludes that metaphysical theories should not be dismissed if they can be criticised [**Popper, 1982**: 199]. Popper's focus on critical attitude shows that he perceives science as an ongoing process. This contrasts with the common perception of PopperN where falsification is a ready-made formula for scientists. **Boland** [**1990**] underlines the importance of critical rationalism and compares it to the Socratic dialogue, where we learn by the constant process of criticism. Thanks to critical rationalism, the scope of theories that can be analysed is expanded. Popper's claim is not only that we do not need to dismiss metaphysical theories which are non-empirical and irrefutable, but that we can analyse them. This is possible because we can ask questions such as "Does it solve the problem? Does it solve it better than other theories? ... Is the solution simple? Is it fruitful? Does it perhaps contradict other philosophical theories needed for solving other problems?" [**Popper, 1963**: 269]. For Popper, all theories are designed to solve problems and should be critically judged by this standard. The main goal of critical rationalism is to keep criticism going. However, this does not mean that scientists must savage every piece of a theory. We must find the optimal size of criticism that would not nip the promising theories in the bud [**Popper, 2002**: 334]. Despite the optimal level of criticism we also need to use a proper kind of criticism. Although Popper identified many ways to assess the MRP, including problem-solving, simplicity, and fruitfulness, the main criterion is testability. Thus, even though Popper accepts some irrefutable metaphysical elements and immunisation strategies, they are accepted only when they enable criticism. Testability is essential because Popper knew how appealing it is for scientists to immunise the MRP from criticism by providing unfalsifiable ad hoc adjustments.

In the end, critical rationalism is a broad and open-ended approach. Thus, it is hard to judge what kind of criticism is proper and how much criticism is required. In the next section, I analyse situational analysis, where unfalsifiable and falsifiable elements conflate. This leads to problems with assessing the metaphysical research programme and immunisation strategies which are essential in the context of NE.

Situational analysis and rationality principle

My main analysis of PopperS concerns his method for social science: situational analysis (SA) based on the rationality principle (RP). I analyse how Popper perceives both concepts. It is a problematic issue because Popper changed his understanding of RP (from objective to subjective) and the scope of SA (from historical to social sciences) over the years. These changes led to various interpretations. Thus, I analyse three prominent situational analysis interpretations in the literature: (1) universal, (2) methodological, and (3) a priori. My goal is not to resolve inconsistencies in Popper's writings, which seems hopeless, but to determine if RP is falsifiable and if it leads to empirical conjectures, which is essential in the context of neoclassical and behavioural economics.

I start my analysis with the universal interpretation because this is how Popper wanted situational analysis to be perceived. In short, SA is an oversimplified reconstruction of social events. It encapsulates the beliefs and goals of people together with the social constraints on which their behaviour is contingent. For Popper, SA is similar to the method used in natural science. It is based on deductive thinking where we construct a basic model (SA) with an animating principle (RP) that plays the same role as Newton's universal law of motion. By indicating rationality principle in the context of SA, we can explain people's actions and make predictions [**Popper, 1994**]. Initially, Popper perceived RP objectively when "agents always act in a manner appropriate to the situation in which they find themselves" [**Popper, 1985**: 361]. Koertge reconstructs Popper's reasoning concerning SA as: "1. Description of the Situation: Agent A was in a situation of type C. 2. Analysis of the Situation: In a situation of type C, the appropriate thing to do is x. 3. Rationality Principle: Agents always act appropriately to their situations. 4. Explanandum: (Therefore) A did x" [**Koertge, 1979**: 87]. Many commentators criticise the universal interpretation of SA [**Hands, 1985**; **Latsis, 1972**; **Koertge, 1975**; **1979**]. We know that objective RP where people always act appropriately to the situation is false. Thus, SA is inconsistent with PopperN's view on natural science because RP is falsified.

Popper had two responses to the fact that objective rationality principle is false. First, he argued that the falseness of RP should not bother us. When a theory where RP is implemented is falsified, we should not dismiss RP but blame a model. Popper argued "that it is sound methodological policy to decide not to make the rationality principle accountable but the rest of the theory; that is, the model" [**Popper, 1985**: 362]. We do not need to falsify RP because it "does not play the role of an empirical explanatory theory, of a testable hypothesis" [**Popper, 1985**: 360]. Popper perceived RP as a "zero principle," a starting point of the analysis, which is "a consequence of the methodological postulate that we should pack or cram our whole theoretical effort, our whole explanatory theory, into an analysis of the situation: into the model [**1985**: 359]." Finally, Popper argued that, for pragmatic reasons, we should stick to RP even if it is false. We need to assume some rough animating principle to explain behaviours. Popper writes: "[T]he attempt to replace the Rationality Principle by another one seems to lead to complete arbitrariness in our model-building" [**Popper, 1994**: 177–178]. Popper's second response to the problem with false RP is to change its understanding. Although Popper seemed not to be bothered with the falseness of the objective RP, with time he ceased to perceive it as a proper animating principle to explain a variety of behaviours. At the beginning, Popper applied RP to the actions of sane people [**Popper, 2013**: 470] but later the scope of RP was widened and included the actions of a madman [**1994**: 178–179]. By widening the scope of RP, Popper moved from objective to subjective RP. The latter states that agents act in a manner which is adequate to their situation as they see it [**Popper, 1985**: 365]. In this way, Popper distances himself from objective RP that was perceived as a universal rule stating that people always act appropriately to the situation and was criticised for being false. For Popper, RP does not mean a rational attitude but is perceived as a "minimum principle" that "animates ... our explanatory situational models" [**Popper, 1985**: 365].

Popper's arguments concerning rationality principle led to two different interpretations of situational analysis in the literature. The first one is to perceive RP as methodological principle, and it is the most popular interpretation [**Watkins, 1970**; **Koertge, 1975**; **1979**; **Hands, 1985**; **Lagueux, 1993**; **Kerstenetzky, 2009**].

Popper's argument that RP can be falsifiable in principle but we do not reject it represents a methodological choice. Even if our theory based on RP is falsified, we will "cling to the rationality principle and revise our hypothesis about his aims and beliefs" [**Watkins, 1970**: 173]. So, we could reject RP but decide not to; thus, Popper's reasons for RP resemble a methodological choice. The second interpretation concerns Popper's move from objective to subjective RP where agents act in a manner which is adequate to their situation as they see it [**Popper, 1985**: 365]. Many find an analogy between subjective RP and von Mises's rationality [**Latsis, 1976**]. This minimal understanding of rationality requires only that people try to achieve their goals, regardless of what those goals may be. An agent is considered rational if they act in line with their beliefs, even if those beliefs are inconsistent, incomplete or mistaken. In this way, the subjective RP is unfalsifiable and SA is perceived in the literature as an *a priori* interpretation.

Popper rejected both the methodological and *a priori* interpretations. He argued that RP could lead to empirical conjectures, so SA should be perceived as a universal principle [**Popper, 1985**: 361]. His defence of SA as a universal principle can be analysed in the context of both the methodological and *a priori* interpretations. First, the unfalsified RP on which a model is built can lead to empirical predictions. Second, in contrast to the *a priori* interpretation, Popper claimed that RP is false, not universally true. I analyse Popper's arguments and assess if they work.

We need to notice the difference between type and singular explanations to reconstruct Popper's argument on situational analysis as the universal principle. Popper underlined the similarity between social and natural sciences because both can provide explanations. Many critics perceive Popper's position as incoherent and his methodological monism as untenable because rationality principle is not falsifiable [**Hands, 1985**; **Latsis, 1972**; **Koertge, 1975**; **1979**]. However, not everyone realises that Popper argued that social sciences should focus on type explanation as we cannot find universal laws [**Popper, 1994**: 163]. Thus, in social science, we predict some general trends (e.g. a seasonal decrease in unemployment in the building industry) but not a particular event as in natural science (e.g., a solar eclipse). Finally, social and natural sciences have the same deductive frameworks but differ in their application. Social sciences explain only type events, whereas natural sciences also explain singular events [**Nadeau, 1993**]. Popper was well aware of the problems with predictions in social and natural sciences. Both deal with complex phenomena, making it hard to find some universal laws. As an example, Popper gives Darwin's theory of evolution which he perceived as a metaphysical research programme [**Popper, 2005b**: 195]. Even though the metaphysical research programme contains unfalsifiable assumptions, it can lead to explanations. To understand complex phenomena we need to construct a model which is a necessary simplification of reality [**Popper, 1994**]. Thanks to a model, we make predictions, but their domain is limited [**Popper, 1996**: 77–80].

The second main issue for Popper was the falsity of RP. Popper rejected the *a priori* interpretation, arguing that "a principle that is not universally true is false." He wrote: "The rationality principle is false. I think there is no way out of this. Consequently, I must deny that it is a priori valid" [**Popper, 1994**: 172]. Popper consistently claimed that RP is false. For him, this merely means that people act in accordance with objective RP, which states that "agents always act in a manner appropriate to the situation in which they find themselves" [**Popper, 1985**: 361]. To prove that RP is false, Popper cited the example of a flustered driver "desperately trying to park his car when there is no parking space to be found" [**Popper, 1985**: 361].

Now, we can analyse if Popper's argument works. The defence of the universal interpretation was that RP in the model could lead to predictions. It seems that the conditions of situational analysis are too vague. We do not define any spatiotemporal or geopolitical conditions (e.g., political and sociological dimensions). Thus, RP is too vague to be perceived as an animating principle providing testable conjectures and serving as an "inference ticket" [**Nadeau, 1993**: 9]. The next problem with universal SA is that it does not contain nomological statements necessary to find laws. **Nadeau** [**1993**] presents the example of the governor of the Bank of Canada who decided to raise the bank rate. Following Popper, we could construct a situational model that explains the governor's decision. We indicate the variables that were taken into consideration by the governor when he made the decision, e.g., the inflation rate in Canada. However, this model of a typical situation

would not indicate the law correlating the increase rate with the reduction in demand (i.e. typical event). We could sufficiently explain the governor's behaviour by assuming that he believed that if he raised the bank rate, other banks would follow suit and eventually consumption would decrease. This example shows that SA does not necessarily need to predict general trends, as Popper argued.

Popper's next argument that RP can be falsifiable and is false does not hold up, either. Popper makes RP unfalsifiable by moving from objective RP (people always act appropriately) to subjective RP (act accordingly as they see it). The example of the flustered driver was intended to show the falsifiability of RP. However, it works only with objective RP. It does not reject subjective RP because there is no way to show that people do not behave according to their knowledge (as they see it). To dismiss subjective RP, we need to show the inconsistency of the driver's beliefs, which is impossible because we cannot know the driver's preferences before the choice is made. Popper's move from objective RP to subjective RP makes RP unfalsifiable. Therefore, subjective RP, which Popper used in his later writings, is perceived as *a priori* valid. As we saw, Popper dismissed this understanding, arguing that RP cannot be a priori valid because it is false [**Popper, 1985**: 361]. However, he never fully explained how we should perceive RP in the driver example [**Popper, 1994**]. The question remains whether we should interpret RP as objective or subjective. If the latter is the case, then RP is unfalsifiable [**Hoover, 2016**].

My analysis concludes that Popper's defence of RP as a useful and falsifiable principle was ultimately unsuccessful. situational analysis based on rationality principle is so vague that it cannot be a reliable method for finding empirical conjectures. Thus, the universal interpretation is invalid. The *a priori* interpretation is also incorrect. Although subjective RP fits the *a priori* interpretation, it does not accurately reflect Popper's understanding of SA. Popper diverged from the Austrian tradition, which relies on *a priori* rationality. He rejected subjectivism and psychologism, instead favouring an institutional analysis approach [**Udehn, 2001**: 210] where the subjective properties of individuals are shaped by institutional conditions [**Popper, 1957**: 154]. Moreover, subjective RP is just one of many possible interpretations of RP. Ultimately, RP fits best with the methodological interpretation. Although Popper rejected this interpretation, his pragmatic reasoning for retaining an unfalsified RP resembles a methodological choice.

At the conclusion of my investigation into PopperS, I analyse SA and RP in the context of neoclassical economics. Although some commentators criticise this analogy [**Notturno, 1998**; **Gorton, 2006**], Popper undoubtedly wanted to ground SA in economic methodology [**Popper, 1945**; **1994**; **1996**; **2005b**]. In SA and NE, I underline the importance of the constraints within which choices are made. In NE, people optimise their choices within constraints (e.g., budget, time, and information), and we assume the existence of preferences. Moreover, NE is based on RP, where rationality is also bounded by constraints. As a result, most commentators recognise a similarity between SA and the logic of choice used in economics [**Latsis, 1972**; **Hands, 1992**; **Hoover, 2016**]. However, not all interpretations assert that NE is grounded in situational analysis. **Palacio-Vera** [**2019**] argues that SA fits more with the methodology used by behavioural economists. This is possible if we interpret RP as a benchmark. We need to analyse this argument further.

In our previous discussion of rationality principle, we saw that it could be interpreted either objectively (agents act appropriately) or subjectively (as the agent saw it). Popper perceived RP in broad terms, as illustrated by his example of a madman, where RP does not require people to behave rationally. Although Popper himself did not make a sharp distinction between RPO (objective) and RPS (subjective), there are places when he argued that problem situations in SA can be reconstructed in two ways: objectively and subjectively " (a) the situation as it was and (b) a very different situation as it appeared to the agent, or as it was understood, or interpreted by the agent" [**Popper, 1972**: 179]. However, in his last work [**1994**], where he tried to clarify RP, Popper added a third "intermediate" version (RPI): "The situation as the agent could (within the objective situation) have seen it, and perhaps ought to have seen" [**Popper, 1994**: 183].

Palacio-Vera [**2019**] reconstructs Popper's distinction and argues that RPI can be perceived as a normative benchmark to which we compare agents' actual behaviours. Palacio-Vera finds a justification for the benchmark interpretation of RP when Popper writes about the deviations in the construction of SA and when we

try "to understand the actions of a person who acts inappropriately to his situation" [**Popper, 1994**: 178]. If we focus on deviation in SA, RPO means that scientists assume that the actor's behaviour is adequate to the problem situation as it actually is or was. RPS here is a deviation from the objective situation, which means that scientists assume that the actor's view of the problem situation is "partially wrong" or "incomplete." From this perspective, RPI indicates how people should perceive the situation. Popper is not explicit about that. Therefore, **Palacio-Vera** [**2019**] uses Popper's distinction between "historical" and "theoretical" social scientists to explain what RPI means. In RPI, historians assume that the actors' view of the problem situation is "incomplete" compared to historians' view, which is correct and complete (RPO). RPI used by social scientists is different. Social scientists assume that the actor's view of a typical situation is "correct" and "complete" when it is the same as the view of social scientists. RPS means the same for historians and theoretical social scientists. Both assume that the actors' view of the problem situation is partially wrong or incomplete.

Palacio-Vera argues that RPO applies exclusively to historians, while RPI pertains to both "historical" and "theoretical" social sciences. Only historians can reconstruct RPO because they study problem situations retrospectively, which provides them with insights that the original actors could not have possessed. In contrast, social scientists focus on "typical" social events, which means they ignore specific factors concerning the historical problem situation, and are thus unable to reconstruct RPO. Consequently, RPI in the social sciences reflects the knowledge that "actors could or ought to see, if they possessed as much knowledge about it as the scientist does" [**Palacio-Vera, 2019**: 5]. Although social scientists cannot reconstruct RPO, Palacio-Vera argues that they possess knowledge that is "wider" and "more complete" than that of the general public. Their privileged position is essential for constructing a more complete picture of problem situations in situational analysis. The main conclusion is that the methodologies of both "historical" and "theoretical" social scientists are based on an ideal benchmark equated with RPI. In this interpretation, social scientists explain typical social events by identifying deviations in actors' behaviour (RPS) from this ideal benchmark (RPI). Palacio-Vera's interpretation can be seen as controversial. However, my intention is not to criticise it; rather, I present it because it is significant in the context of my paper, particularly when comparing behavioural economics and neoclassical economics. This is pertinent because Palacio-Vera argues that RPI (the benchmark) aligns more closely with the methodologies used by behavioural economics than with those in neoclassical economics. How is this possible?

I have already noted that Popper held neoclassical economics in high regard, arguing that situational analysis represents a generalisation of the neoclassical theory of individual behaviour [**Popper, 1994**: 154]. However, **Palacio-Vera** [**2019**] contends that NE does not fit the rationality principle interpretation as a benchmark. The problem with NE is that it assumes economic agents possess as much knowledge about a problem situation as economists do. Thus, RPS effectively equates to RPI. We cannot use RP as a benchmark for comparing agents' deviant behaviours because agents always choose options that satisfy their preferences, and no one can do this better than they can. Palacio-Vera argues that the RPI interpretation implies that, in SA social scientists have a "wider" or "more complete" view of the problem situation than individual actors. This assumption is crucial if we are to learn from people's mistakes, suggesting that the actors' understanding of the problem situation is "partially wrong" or "incomplete". **Palacio-Vera** [**2019**] identifies this perspective in new behavioural economics, which often employs ideal benchmarks to pinpoint deviations by examining how people actually behave. A prime example is subjective expected utility (SEU) theory, which serves as a benchmark (null hypothesis) against which actual behaviours are compared. **Palacio-Vera** [**2019**] posits that behavioural economists implicitly adhere to Popper's RPI. Using SEU as a benchmark can improve a model's explanatory power. By identifying systematic deviations from the predictions made by rational choice theory, behavioural economists can explain anomalies in agents' behaviours.

As we have established, for RPI to function as a benchmark in situational analysis, we need to assume that social scientists have a broader and more comprehensive understanding than actors do. In this context, **Palacio-Vera** [**2019**] compares NE with behavioural welfare economics. As I have indicated, scientists do not possess more knowledge than actors in NE. An example of this line of thinking is Paretian welfare economics, where

perfect competition serves as a benchmark from which deviations (market failures) are identified. However, in NE, we assume that agents always maximise their utility, implying that neither the state nor scientists should interfere, as they cannot choose better than individuals can. In this sense, NE does not work in the context of RPI because there is no possibility of using a benchmark to improve agent behaviour. Behavioural welfare economics, on the other hand, differs in that it assumes social scientists have more knowledge about certain problem situations than ordinary people do. Behavioural welfare economists believe they have a normative benchmark that shows how people should behave to maximise utility. This belief is evident in the concept of libertarian paternalism, where individuals who exhibit deviations (irrational behaviours) from the normative benchmark (*homo economicus*) are guided toward that ideal behaviour [**Thaler, Sunstein, 2008**].

PopperS in the context of behavioural economics' criticism of neoclassical economics

In the final section of the paper, I use previous conclusions to judge whether neoclassical economics' immunisation strategies against behavioural economics are justified. This analysis has two objectives: one descriptive and the other normative. The first objective is descriptive, whereby I examine how Popper might have viewed neoclassical economics' immunisation strategies. The second, normative, objective involves assessing Popper's methodology itself and identifying its limitations within the context of NE (prediction and unfalsifiable RP). Moreover, I assess recent changes in NE in the context of "reverse imperialism" (i.e. the process of opening economics to other social sciences, such as psychology, anthropology, and sociology) to show that my analysis is not merely historical. Before starting, I synthesise the main conclusions from Popper's analysis. First, not all immunisation strategies are wrong. They can provide more testability in the future. Second, the metaphysical parts are not bad in themselves. They guide researchers and help solve problems. Third, although testability is essential for Popper, a critical attitude can be enough to distinguish between good and bad metaphysical research programme. The fourth claim concerns situational analysis and rationality principle. I argue that SA aligns closely with a methodological interpretation.

I focus on Becker's economic approach to understand how neoclassical economics' immunisation strategies work. Why Becker? First, Becker's economic approach is similar to SA [**Hoover, 2016**]. It is based on RP, which serves as an animating principle where people act within a given situation (within constraints). Second, rational choice theory is perceived as a universal method for social science. Third, RP in the economic approach is unfalsifiable [**Blaug, 1992**], which shields it from criticism concerning utility maximisation and rationality. Moreover, the economic approach is a paragon of economic imperialism and economic thinking [**Lazear, 2000**]. The economic approach can be perceived as the end result of the immunisation strategies that started in the 20th century (move from cardinal to ordinal utility, from perfect to instrumental rationality). In general, I use Becker's economic approach to clarify immunisation strategies used by NE. In the literature, there are other accounts which show how NE defended itself from descriptive axioms (e.g., **Berg, Gigerenzer** [**2010**]; **Dow** [**2012**]; **Kapeller** [**2013**]). Despite the differences in our analyses, the conclusions are similar.

Neoclassical economics' reaction to behavioural economics' criticism

In analysing behavioural economists' criticism of NE, I focus on Thaler's "gauntlet": bounded rationality, bounded self-interest, and weakness of will [**Thaler, 2015**]. Combined, these critiques question the traditional assumption that individuals always choose the best (maximise their utility). I identify two core criticisms of NE from this perspective: one descriptive and one methodological. The descriptive criticism contends that RP is just false, and people do not act according to rational choice theory. The methodological critique argues that RP is unfalsifiable and thus cannot lead to any predictions. The reader may notice that the same criticism was aimed at Popper's RP. My analysis of NE has a similar structure to the previous analysis of Popper. First, I show how SA and RP work in the economic approach. Second, I assess the methodological problems arising from neoclassical economics' reliance on immunisation strategies.

Bounded rationality

For most of the 20th century, NE perceived people as hyper-rational agents that can compute an infinite amount of information and choose the best option. However, perfect rationality was an object of criticism that has intensified since behavioural economics gained popularity in the 1980s [**Thaler, 2015**]. Nowadays, it is evident that people do not always process all information and often behave irrationally. Neoclassical economists use two main immunisation strategies to deal with anomalies.

The first strategy is to underline the role of constraints and argue that people optimise, not maximise. Neoclassical economists argue that people would make perfectly rational choices if it were not for various constraints such as limited time, information and cognitive powers. Becker writes that "actions are constrained by income, time, imperfect memory and calculating capacities, and other limited resources, and also by the opportunities available" [**Becker, 1993**: 386]. I present two examples that reflect this line of thinking. The first is heuristics, which neoclassical economists do not consider irrational because people do not have enough time to digest every information. If we had to think about every move, we would not be able to live [**Kahneman, 2011**]. The second example is bounded rationality [**Simon, 1957**]. Bounded rationality exists because there is not enough time to process all information and our cognitive powers are limited. Although bounded rationality criticises perfect rationality (maximisation), it does not dismiss instrumental rationality because in NE rationality is always bounded (optimisation) due to the world's complexity. Neoclassical economics' focus on constraints works as in situational analysis. Moreover, it resembles an ad hoc strategy. When neoclassical economists notice anomalies, e.g., irrational behaviour, they blame it on the external situation (constraints) and not a theory.

The second immunisation strategy used by NE resembles the modification of ostensible definitions. Neoclassical economists deal with irrational behaviours by changing the understanding of rationality [**Hodgson, 2012a**]. In common view, rationality means wise choice. However, neoclassical economists do not discuss goals because it is impossible to decide what people should want rationally [**Stigler, Becker, 1977**]. Thus, economists only check if people satisfy their preferences effectively, e.g., the only way for economists to state that an alcoholic behaves irrationally is if he or she mistakenly buys apple juice instead of vodka. Ultimately, the notion of instrumental rationality looks similar to Popper's subjective RP, which is unfalsifiable.

As a result of both immunisation strategies, people always behave rationally. It is impossible to falsify this statement in NE. However, some parts of rational choice theory can be falsified. The process of choice needs to meet two conditions: transitivity and completeness. Later I analyse what it means for neoclassical economics.

Bounded self-interest

The second main criticism from behavioural economics is aimed at the concept of homo economicus who always behaves egoistically and cares only about utility maximisation. Behavioural economists show many examples when people behave altruistically (e.g., dictator game; **Kahneman et al. [1986]**.

Becker, like neoclassical economics, relies on the utility maximisation hypothesis. He argues: "Everyone recognizes that the economic approach assumes maximizing behavior more explicitly and extensively than any other discipline" [**Becker, 1976**: 5]. The crucial issue here is how utility is perceived. Becker understands utility *ad libitum*, where utility can mean everything. By broadening the conception of utility, Becker answered two different kinds of criticisms of homo economicus (the criticism concerning weakness of will is analysed separately). By perceiving utility *ad libitum*, Becker embraced altruistic behaviours into the process of maximisation. From the beginning, economics had been accused of perceiving people as selfish creatures. Becker did not identify maximisation with self-interest and argued that "individuals maximize welfare as they conceive it, whether they be selfish, altruistic, loyal, spiteful, or masochistic" [**Becker, 1993**: 386]. Therefore, it does not matter if people are altruists or egoists because they always maximise their utility.

By perceiving utility *ad libitum*, economists can explain altruistic behaviours which are anomalous to homo economicus. For example, we can argue that people maximise their utility by giving money to strangers in the

dictator game. This immunisation strategy works like the modification of ostensible definitions. In NE, we change the understanding of utility, which incorporates egoism and altruism. Although this strategy is most prevalent in NE, an ad hoc strategy is also used. We can maintain that people always behave egoistically, e.g., people give money in the dictator game because they get pleasure from helping others. This strategy is analogous to psychological egoism where every behaviour, even altruistic one, is explained by self-interest.

To conclude, by changing the understanding of utility, NE maintains that people always maximise their utility. The examples of altruistic behaviours do not disprove the utility maximisation hypothesis because it is unfalsifiable[3].

Weakness of will

The last analysed criticism from behavioural economics concerns weakness of will. Behavioural economists argue that people do not always choose what is best for them [**Thaler, 2015**]. In this way, behavioural economics criticises both rationality and utility maximisation. Although I analysed rationality and utility maximisation separately, they are used interchangeably in NE because they amount to the same thing: people always do what is best for them.

A Theory of Rational Addiction [**Becker, Murphy, 1988**] shows how immunisation strategies that broaden the understanding of utility and rationality work. Regarding rationality, Becker and Murphy claim that "addictions, even strong ones, are usually rational in the sense of involving forward-looking maximization with stable preferences" [**1988**: 675]. The article's point is that addicted people are not irrational and their behaviours are not anomalies. Becker and Murphy argue that taking drugs is rational. This is possible because they use instrumental rationality: "This paper relies on a weak concept of rationality that does not rule out strong discounts of future events. The consumers in our model become more and more myopic as time preference for the present (a) gets larger" [**1988**: 683]. Taking drugs maximises utility because pleasure from drugs now is so immense that it outweighs future costs. It looks strange that being addicted to heroin is rational. However, NE does not assume what is good for people. We assume that individuals maximise their utility in the moment of choice. For Becker, weakness of will does not occur and people somehow compare their long-term goals (health) with short-term pleasures (being doped).

Two primary immunisation strategies are applied to the concept of weakness of will in neoclassical economics. The first involves modifying ostensive definitions, where rationality is viewed purely instrumentally. Under this perspective, economists refrain from making judgments about what is inherently good for people. For example, even a drug addict is considered to be maximising their utility because utility is perceived *ad libitum*. The second strategy involves introducing an ad hoc hypothesis. When a drug addict claims that they do not want to do drugs, neoclassical economists assure them that deep down they wanted to take drugs because apparently a short-term pleasure was so immense that it outweighed the future costs. Otherwise, the person would not have taken drugs**.**

Conclusion

My analysis shows that neoclassical economics' immunisation strategies lead to the tautological notions of rationality and utility, rendering RP (optimisation) unfalsifiable. The unfalsifiability of rationality principle is evident in the context of rational choice theory, which assumes that people always choose what is best for them [**Sen, 1977**; **Hodgson, 2012a**]. Behavioural economists critique rational choice theory by highlighting that people do not always behave rationally or maximise their utility. We could observe that economists use immunisation strategies to defend rational choice theory, mainly by expanding the notions of utility and rationality – modifying ostensible definitions. By viewing rationality instrumentally and utility *ad libitum*,

[3] Not everyone agrees with this. Guala [2000] argues that the expected utility theory can be normatively falsified (discussion on EUT, see **Małecka** [**2020**]).

these strategies can explain any anomaly. As a result, they can be interpreted as ad hoc strategies. The main argument is that neoclassical economists change their understanding of utility, self-interest, and rationality to escape criticism. Although neoclassical economists accept that people are not perfectly rational and egoistic, they still hold to the axiom of optimisation. Ultimately, its immunisation strategies result in unfalsifiable notions of instrumental rationality and utility *ad libitum*. However, as I noted earlier, PopperS did not claim that all immunisation strategies or unfalsifiable assumptions should be dismissed. Now, I apply Popper's perspective to assess neoclassical economics' immunisation strategies.

The assessment of neoclassical economics' immunisation strategies

As shown, immunisation strategies in NE lead to a tautological understanding of utility and rationality, the two key concepts that are the basis for rationality principle. The primary strategy NE uses is modifying ostensible definitions. Neoclassical economists changed the understanding of rationality from perfect to instrumental and utility from ultimate good to *ad libitum*. Using immunisation strategies is not bad in itself; the problem arises when these strategies are merely ad hoc [**Hands, 1988**]. To evaluate neoclassical economics' immunisation strategies, I explore their historical context, which was crucial for Popper. He argues that Freud's theory was born unfalsifiable, whereas Marx's supporters added ad hoc assumptions later [**Popper, 2005b**: 44–45]. From this perspective, NE resembles Marx's story. In the beginning, NE defined rationality and utility, and only later changed their meaning. However, there is a difference between Marx and NE. Marx's followers added the ad hoc hypothesis only to deflect criticism (e.g., justifying the lack of the anticipated revolution), whereas the context of NE was different. Neoclassical economists did not modify ostensible definitions solely to escape criticism but to resolve some problems within the NE framework [**Hands, 1988**]. Thus, they did not behave like a scientist who sees a white raven and argues that this bird is not a raven.

From the very beginning, neoclassical economists had problems with the subjectivity of rationality and utility. Thus, they moved from cardinal to ordinal utility, and from perfect to instrumental rationality**.** While this evolution can be framed as an immunisation strategy, it also served as a framework to explain anomalous behaviours. This approach can be found in Becker's assertion that "a rational framework permits new insights into addictive behavior" [**Becker, Murphy, 1988**: 675]. With time, rational choice theory expanded into fields such as sociology and criminology to explain various behaviours. From this perspective, economic imperialism, based on rational choice theory, is analogical to Popper's argument that rationality principle and situational analysis should underpin all social sciences. Thus, the axiomatic assumptions of NE should not be seen as a weakness but as its strength [**Lazear, 2000**]. The changes in the understanding of utility and rationality are not an ad hoc process but a justified methodological framework that explains many unexplained behaviours (e.g., irrational and altruistic behaviours) and enables prediction. In the remainder of this subsection, I analyse if the methodological justification of RP is warranted.

The first argument for relying on axiomatic rational choice theory (RCT) is that NE uses unrealistic models of human behaviour ["as if" argument; **Friedman, 1953**]. NE does not rely on psychology to understand the motives behind individuals' choices because rational choice theory aims to predict some general trends. This thinking is exemplified by Becker, who used RCT to explain the crime rate, marriage market and discrimination. From this perspective, neoclassical economics' inability to predict how each individual behaves is not a problem. NE focuses on tendencies and laws (e.g., diminishing utility). Popper used the same reasoning and argued that social sciences rely on "type" explanations. The problem is that utility maximisation can produce entirely different results in different contexts. Depending on what gives more utility, people will behave egoistically or altruistically, take drugs or abstain from them. Consequently, NE explains behaviours *post factum*, and cannot predict them. RP is too vague to have predictive power. As I noted earlier, Popper encountered the same criticism [**Hands, 1985**; **Nadeau, 1993**], which suggests that the criticism levelled at NE can be perceived as unjust because prediction is problematic in all social sciences. Yet, the problem is amplified in NE because neoclassical economics explicitly focuses on prediction [**Rosenberg, 1992**; **Hands, 1984**; **1990**].

The second argument for neoclassical economics' axiomatic RCT is that some of its parts are falsifiable. Rational choice theory is based on the Weak Axiom of Revealed Preferences (WARP), which assumes consistency and completeness in preferences. In this way, RP is not arbitrary and can be falsified. This strategy was used by Becker, who assumed stable preferences in his approach [**Becker, 1976**]. However, the main problem with the consistency assumption is that it is false, as behavioural economics shows [e.g., preference reversals, present bias, and prospect theory; see **Thaler, 2015**]. NE accepted this criticism but it had a limited effect on its methodology. For example, NE dismisses weakness of will. Neoclassical economists can claim that drug addicts' preferences are not inconsistent over time because of preference reversals or present bias. It is impossible to demonstrate inconsistency because neoclassical economists focus on choices, not declarations [**Ostapiuk, 2022**]. Moreover, we cannot conclude from inconsistent preferences that people do not maximise their utility, e.g., someone declares that they want to eat healthy and then go to a McDonald's restaurant. Sugden used a similar argument against libertarian paternalism's search for purified preferences. Because preferences are context-dependent we cannot know them before the choice is made [**Sugden, 2018**]. The most important conclusion here is that Popper encountered the same problem with RP as neoclassical economists. The objective RP was false, as shown in the example of a driver who behaves irrationally by attempting to park in a space that is too narrow. To counter this criticism, Popper employed a subjective RP. However, the subjective RP cannot be falsified because we cannot access people's beliefs, which is necessary to identify inconsistencies. NE follows a similar trajectory: to escape criticism, it moved from objective, falsifiable rationality (WARP) to an instrumental rationality that cannot be falsified, later justifying this as a methodological choice.

My analysis indicates that rationality principle in NE is so arbitrary that it precludes prediction. However, PopperS claims that unfalsifiable theories can be justified if they lead to new knowledge. I analyse Popper's critical rationalism and metaphysical research programme in the context of NE.

First, Popper underlines the historical context when judging metaphysical research programme. For him, scientists should move from untestable metaphysical assumptions to testable ones. In NE, the reverse is the case. Neoclassical economists used testable assumptions (perfect rationality and cardinal utility) before moving to tautologies (instrumental rationality and utility *ad libitum*). Thus, from the historical perspective, metaphysical research programme used in NE does not seem to develop in terms of RP (optimisation). It is a strong claim; I do not claim that the whole NE moved towards unfalsifiability (e.g., empirical turn; **Backhouse, Cherrier [2017]**).

Second, Popper argued that new theories should be closer to the truth with time. Neoclassical economists argued that the rational choice theory gradually became detached from reality. Therefore, they applied an instrumentalist defence of unrealistic models [**Friedman, 1953**]. This strategy would likely be disfavoured by Popper, who opposed instrumentalism, the idea that only prediction matters [**Popper, 1994**: ch. 8]. Although Popper admits that all scientific theories are instruments, they are not mere instruments for prediction. They can explain and expand our understanding of the world, e.g., by asking "why" and "how" questions. Instrumentalism is not enough because "science aims at truth, or at getting nearer to the truth" [**1994**: 174; see also **Popper, 1963**: ch.3]. Although falsificationism states that no theory is ultimately true, we can find which theory is "a better approximation to the truth" [**Popper, 1994**: 176].

Third, Popper argues that immunisation strategies are acceptable only if they improve testability or problem-solving. I analysed neoclassical economics' problems with testability due to the tautological nature of rationality and utility. But what about problem-solving? NE struggles to address concepts such as weakness of will, distinctions between egoism and altruism, self-interest versus moral values, and rationality versus irrationality. NE can technically account for any behaviour within its framework, but the value of such explanations is questionable. For example, in NE, a heroin addict maximises her utility whether she takes the drug or abstains. Similarly, in the dictator game, utility is maximised whether a player gives money or keeps it.

To conclude, when judged by Popper's standards, neoclassical economics' metaphysical research programme, grounded in RP, has not developed because tautological assumptions hinder a critical approach. As a result, economic imperialism has emerged. I recognise that my claim – that NE has remained static due to immu-

nisation strategies – may seem controversial. My intent is not to imply that behavioural economics has had no impact on NE or that no changes have occurred. In this paper, I argue that the lack of change specifically pertains to neoclassical economics' optimization axiom. Moreover, my analysis focuses on neoclassical economics' use of immunisation strategies and its largely negative reaction to behavioural economics criticisms. I acknowledge that my depiction of neoclassical economics and behavioural economics may appear outdated, especially given neoclassical economics' recent shift towards behavioural economics through reverse imperialism and an "empirical turn." Thus, in the final section of the article, I argue that despite adopting some of behavioural economics' insights, NE continues to rely on the optimisation axiom. I further analyse these recent shifts through Popper's perspective.

Assessing the changing nature of neoclassical economics

My earlier description of behavioural economics' criticism toward NE reflects the situation in the 1980s. At that time, behavioural economists strongly criticised NE and advocated for a completely different paradigm. Neoclassical economists, on the other hand, dismissed behavioural economics' findings and did not treat them seriously (see **Thaler [2015]**). However, over time, this changed and behavioural economics became part of the mainstream. For example, Sent writes that "new behavioral economics situated itself squarely within the mainstream" [**2004a**] and Angner proclaims that "we're all behavioral economists now" [**2019**]. Thaler's Nobel Prize for 2017 can serve as an example of the final acceptance of behavioural economics into the mainstream. Although Kahneman received the Nobel Prize much earlier, he was a psychologist, not an economist. Today, neoclassical economists accept and use ideas from behavioural economics, such as prospect theory, hyperbolic discounting, bounded rationality, and heuristics. The current process of adopting insights from other social sciences including psychology is called "reverse imperialism." This process is used as an argument that NE has evolved from a strictly neoclassical framework to a broader, more empirically based mainstream [**Colander et al., 2004**; **Colander, 2010**; **Davis, 2006**; **Rodrik, 2015**; **Cedrini, Fontana, 2018**]. Does this shift in economics invalidate my previous argument that NE has not abandoned the optimisation axiom?

I do not believe so. I earlier discussed some of neoclassical economics' immunisation strategies against behavioural economics. Initially, behavioural economics' criticism was more radical, and neoclassical economics' immunisation strategies defended it against these challenges. I demonstrated how NE defended the optimisation axiom by relaxing assumptions and redefining rationality and utility. With time, these immunisation strategies enabled neoclassical economics to incorporate the behavioural economics' insights without threatening the optimisation axiom. When behavioural economics' insights no longer threaten the optimisation axiom, they can be assimilated. This assimilation strategy means that neoclassical economists have in recent years incorporated behavioural economics' insights within the optimisation axiom (see **Berg, Gigerenzer [2010]**; **Dow [2013]**; **Osmani [2019]**). For example, prospect theory can be modified by changing the shape of the utility function [**Osmani, 2019**]; bounded rationality can be modelled within game theory [**Sent, 2004b**]; and hyperbolic discounting can be modelled within the utility framework [**Ericson, Laibson, 2019**]. Moreover, other-regarding preferences can be assimilated within rational choice theory (e.g., **Fehr, Schmidt [1999]**; **Gintis [2007]**). In the end, the optimisation axiom is sustained, even as behavioural economics' insights are integrated within NE.

My analysis shows that new behavioural economics, which focuses on heuristics and biases, can be considered part of broad neoclassical economics. This interpretation is not uncommon (see **Sent [2004a]**; **Earl [2010]**; **Berg, Gigerenzer [2010]**; **Dow [2013]**; **Truc [2018]**). I argue that new behavioural economics is accepted because its criticisms do not threaten neoclassical economics' optimisation axiom. Some scholars, however, attribute its acceptance to its employment of mathematics (e.g. **Sent [2004a]**; **Earl, Peng, [2012]**). While I agree that mathematics plays an important role, I believe that the optimization axiom better explains why NE accepted new behavioural economics. Historically, in the 1980s, neoclassical economists rejected new behavioural economics, viewing it as an alternative programme that could potentially replace NE. Over time, however, neo-

classical economists found a way to evade criticism and assimilate insights from new behavioural economics within the optimisation axiom. At the same time, behavioural economists gradually presented their work not as an alternative paradigm but rather as an improvement to NE [**Sent, 2004a**; **Earl, Peng, 2012**]. The use of mathematics facilitated the acceptance of new behavioural economics, but first, neoclassical economists needed to be sure that it did not threaten their axiom.

To understand why sustaining the axioms of optimisation is essential in accepting new behavioural economics by NE, I analyse its heterodox sibling, old behavioural economics, which is not accepted by NE. I focus on Simon, the main representative of old behavioural economics [**Sent, 2004a**]. Earlier, I showed that Simon's "bounded rationality" was incorporated within the NE optimisation framework. However, it was a case of misappropriation. First, Simon's bounded rationality is more than just criticism of maximisation. Second, Simon did not perceive bounded rationality as optimisation (best choice within constraints). In reality, Simon proposed an alternative to NE with a different understanding of rationality. He wrote about "satisficing" when conventional knowledge and aspiration levels are essential [**Simon, 1957**]. Satisficing is different from optimisation because people make choices that are "good enough," not the best choices within constraints. Unlike neoclassical economics, Simon did not believe that the behaviour of individuals can be deduced from an objective environment. Instead, he argued that we must know their mental processes [**Simon, 1957**]. Because Simon proposed an alternative programme with a different axiom than NE, it has not been accepted by the mainstream. The same is true of "fast and frugal heuristics [**Gigerenzer, Todd, 1999**]", which rejects neoclassical economics' optimisation axiom and offers an alternative; hence it also remains outside the mainstream.

The first argument in this section was to show that, despite incorporating behavioural economics, neoclassical economics' optimisation axiom has not changed fundamentally. Now, I turn to Popper to assess neoclassical economics' incorporation of behavioural economics. This analysis is tentative because Popper did not write about behavioural economics. However, from this paper's perspective, it is valuable to consider how Popper might judge recent changes within NE.

From Popper's perspective, the first obvious advantage of behavioural economics is its critical spirit. The entire program was designed to critique NE, which, after WWII, was based on simplified assumptions. Behavioural economists have conducted thousands of experiments debunking many of rational choice theory's assumptions. A paragon of this critical approach is Thaler, who systematically identified anomalies within rational choice theory [**Thaler, 2015**]. Additionally, behavioural economics provides theories closer to reality, as seen in prospect theory and hyperbolic discounting, which better reflect actual human behaviour, acknowledging bounded rationality, bounded egoism, and weakness of will. Finally, behavioural economists are better at problem solving: hyperbolic discounting helps explain weakness of will, altruism explains why people give money to strangers in the dictator game, and heuristics clarify why people make judgment errors.

From this perspective, it appears beneficial that NE has incorporated behavioural economics. However, Popper would likely take issue with behavioural economics because he opposed using psychological explanations in situational analysis [**Thaler, 2015**]. Popper wrote that the "'psychological' part of the explanation is very often trivial" [**Popper, 2013**: 308]. He was especially critical of psychologism, which he defined as "the study of society, in the last analysis, must be reducible to psychology" [**Popper, 2013**: 299]. For Popper, psychologism's main flaw is that it "fails to understand the main task of the explanatory social sciences" [**Popper, 2013**: 306]. To understand Popper's hostility toward psychological explanation we can analyse his approach to Marx's method. Popper's positive attitude toward Marx can be surprising for people who read only *The Poverty of Historicism* [**Popper, 1961**]. For Popper, Marx's questioning of psychologism was his "greatest achievement as a sociologist" [**Popper, 2013**: 300]. Popper's situational analysis is not based on psychological explanations but is closer to Marx's use of "the 'logic of the class situation' to explain the working of the institutions of the industrial system" [**Popper, 2013**: 326]. While Popper's views are often seen through an institutional lens emphasising the role of norms and institutions [**Agassi, 2009**], this does not mean he would support institutionalism in economics. He advocated for methodological individualism over methodological collectivism

[**Popper, 2013**: 303–304]. However, it seems unlikely he would support a movement toward behavioural economics, given its psychological foundations. For similar reasons, he would likely disapprove of neuroeconomics.

The second issue in assessing behavioural economics through Popper's lens concerns my previous analysis of Palacio-Vera's take on Popper's rationality principle in the context of behavioural welfare economics. As discussed, interpreting RP as a benchmark is feasible [**Palacio-Vera, 2019**]. While this interpretation is possible, taking stock of Popper's various writings suggests he would object to how welfare behavioural economists use RP. One problem is that RP serves as a benchmark, assuming scientists possess broader knowledge than people who make mistakes [**Palacio-Vera, 2019**]. This assumption may lead to a situation where behavioural welfare economists try to "help" people achieve ideal rationality through approaches such as libertarian paternalism. Although Popper was more of a social liberal than a libertarian [**Shearmur, 2002**; **Ryan, 1985**], he would likely oppose constraining peoples' freedom to improve welfare. Firstly, **Popper** [**2013**] strongly opposed philosopher kings, such as Plato and Marx, who presumed to know what is best for others. Some behavioural welfare economists can be viewed similarly, as they claim scientific authority over what is good for people. As an opponent of any authority, Popper would reject this stance. Secondly, as a proponent of negative utilitarianism [**Shearmur, 2002**], Popper argued that the state's role is to prevent harm rather than promote happiness, as it is unclear what happiness means for each individual [**Ryan, 1985**]. Thirdly, Popper's emphasis on critical learning extends to individuals; if the state decides for people, they lose the opportunity to learn and grow from their mistakes. Fourthly, Popper did not view RP as a rational approach but rather as an essential principle in constructing situational analysis. Some behavioural economists treat RP as a normative ideal rather than a useful benchmark [**Infante et al. 2016**].Popper, in opposition to behavioural economists, was reluctant to define rationality. In the case of madmen, Popper concedes only that a person is not rational if they do not want to learn and think critically [**Popper, 1985**: 363–365]. To sum up, Popper would oppose the way behavioural welfare economists interpret RP. However, this does not dismiss RP's use as a benchmark. The problem lies not with the benchmark interpretation itself but with the approach of some behavioural welfare economists who nudge people towards this benchmark, whereas for Popper, it was intended solely as a tool.

Ultimately, we will not find a direct answer in Popper's work on how he would perceive changes in economics. Some problems stem from Popper himself: he did not provide explicit criteria for judging metaphysical research programmes, and his interpretation of rationality principle evolved inconsistently over time. Moreover, evaluating changes in economics is not an easy task. It is difficult to pin down what NE means today. Some scholars argue that NE has broadened into the mainstream [**Colander et al., 2004**; **Colander, 2010**; **Davis, 2006**; **Rodrik, 2015**; **Cedrini, Fontana, 2018**], while others contend that neoclassical economics' core remains unchanged [**Berg, Gigerenzer, 2010**; **Dow, 2012**; **Hodgson, 2012a**; **Kapeller, 2013**; **Gräbner, Strunk, 2020**; **Ostapiuk, 2019**; **2021**]. Defining behavioral economics is equally challenging. In this paper, I aimed to outline a coherent version of behavioural economics. While my simplified account does not capture the full complexity of the approach, it highlights key differences between old and new behavioural economics.

This lack of conclusive answers from Popper mirrors the challenges in evaluating recent changes in economics. Mainstream economists view recent developments as progress, bringing greater realism through reverse imperialism and an empirical turn. Meanwhile, heterodox economists argue that economics remains anchored to the same unfalsifiable optimisation axiom, which they believe hinders advancement in the field.

Conclusions

This article's departure point was a critique of neoclassical economics by behavioural economics, focusing on neoclassical economics' assumptions about fully rational agents who always maximise utility. These assumptions are flawed because people are neither fully rational nor always utility-maximising. However, descriptive criticism is not very effective because neoclassical economics uses rationality principle based on optimisation where utility and rationality are unfalsifiable. Thus, judged by a falsifiability criterion, neoclassical economics

can be criticised as unscientific. Despite the criticism, neoclassical economics' core optimisation axiom remains the same. In this context, I re-examine Popper's views to offer fresh insights into ongoing debates.

In the article's first part, I compare PopperN (natural science) with PopperS (social science) to see if the unfalsifiable assumptions and immunisation strategies used by neoclassical economics are acceptable. I conclude that immunisation strategies are not inherently problematic. They can contribute to the development of metaphysical research programme. In the context of unfalsifiable assumptions, I reconstruct Popper's situational analysis because it is similar to neoclassical economics' approach. Popper argued that while rationality principle is unfalsifiable, it can still yield testable explanations and guide scientific inquiry. In the second part, I use Popper's views to examine behavioural economics' immunisation strategies for absorbing neoclassical economics' critiques. I focus on bounded rationality, bounded egoism, and weakness of will. This analysis is conducted in the context of Becker's economic approach. It has two aims: descriptive and normative. As part of the descriptive objective, I examine how neoclassical economics employs ad hoc hypotheses and modifies ostensible definitions to sidestep behavioural economics' critiques. I conclude that neoclassical economics absorbs criticism in a way that renders rationality principle tautological, framing optimisation within rationality and utility. Yet, neoclassical economists defend their methodology because they do not want their theories to be mere tautologies – a reasoning that resembles Popper's defence of situational analysis and rationality principle. As part of the normative goal, I assess neoclassical economics' methodological defence, asking if unfalsifiable rationality principle leads to testable hypotheses and valid type explanations. I identify two issues for neoclassical economics similar to those facing Popper. First, rationality principle is too vague to provide valuable explanations about optimisation. Second, expanding rationality principle's scope undermines its falsifiability.

From these points, I conclude that an neoclassical economics approach based strictly on axiomatic rationality principle does not lead to testable hypotheses or solve problems effectively, at least in the cases examined. neoclassical economics' defence strategies appear ad hoc, aimed primarily at deflecting criticism and preserving the optimisation axiom. Although neoclassical economics has incorporated insights from behavioural economics, this has occurred only where behavioural economics' findings do not challenge this axiom.

The novelty of this article lies in revisiting Popper's relevance to economics. Popper's work has largely fallen out of favour in the philosophy of economics. PopperN was abandoned because falsificationism was considered incompatible with economic practice. PopperS was set aside due to inconsistencies between situational analysis and rationality principle, as well as its ambiguous stance and immunisation strategies. My reanalysis of PopperS leads to two significant conclusions. First, critics should avoid lambasting neoclassical economics' unfalsifiable assumptions and immunisation strategies because PopperS does not unequivocally dismiss them. Second, situational analysis with rationality principle, as used in neoclassical economics, is overly vague and does not yield predictive success in economics.

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