The Relation of Neoclassical Economics to other Disciplines: The case of Physics and Psychology

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Abstract

Since the emergence of the classical school, the scientific ideal of physical sciences has been a constant influence on economic theory and method. Its influence is still present in contemporary neoclassical economics. Similarly to the case of physics, classical economists were very open in incorporating psychological elements in the economic discourse. This openness towards psychology continued with prominent Marginalist economists, like Jevons and Edgeworth, who were eager to draw from psychological ideas found in earlier authors. In the first decades of the 20th century, a major conceptual change in economics took place which is also known as the *Paretian turn*. This conceptual change, initiated mainly by Vilfredo Pareto, and completed, in the first decades of the 20th century, by J. Hicks, R. Allen and P. Samuelson, attempted to remove all psychological notions from economic theory. The legacy of the *Paretian turn* can still be identified in the significant reluctance of the contemporary orthodox economic theory to incorporate the findings of the new behavioral economics, a field with a discernable psychological bent. This chapter argues that the history of the relation of those two subjects to economics can lead to some potentially useful observations concerning the nature of contemporary neoclassical economics. It will also be maintained that the relationship of neoclassical economics to physics ultimately constrained its interaction with psychology.

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I. Introduction

Since the emergence of the classical school, the scientific ideal of physical sciences has been a constant influence on economic theory and method. Examples of this influence can be found in the works of many leading classical economists. The classical physics model of science became more prevalent with the appearance of Marginalism. The economic thought of F.Y. Edgeworth, V. Pareto and I. Fisher shows that this trend continued with early neoclassical economics (Mirowski, 1989). Core components of contemporary mainstream methodology are also clearly influenced by the classical physics scientific method. The dominance of mathematical formalism, the conception of economics as a positive science, the complete separation of moral questions from the purpose of economics, and the emphasis on prediction, are indications of the influence of physics (Dow, 2002).

Similarly to the case of physics, classical economists were very open in incorporating psychological elements in economic discourse. The relevant work of authors such as J. Bentham, Adam Smith, N. Senior, J. Cairnes, James and John Stuart Mill, are indicative examples in this respect (Drakopoulos and Katselidis, 2019). The openness towards psychology continued with prominent marginalist economists like W. S. Jevons, F. Y. Edgeworth and P. Wicksteed who were eager to draw from psychological ideas found in earlier authors (Goodwin, 2016). Importantly, the incorporation of psychological ideas into economic theory laid the ground for the emergence of the systematic subjective theory of value which was mainly based on the specific framework of psychological hedonism.

In general and up to the beginning of the 20th century, there was almost no methodological objection regarding the incorporation of ideas from psychology into economic theories. After this period however, a major conceptual change in economics

took place which is also known as the *Paretian turn* (Bruni and Sugden, 2007). This conceptual change, initiated mainly by Vilfredo Pareto and completed in the first decades of the 20th century by J. Hicks, R. Allen and P. Samuelson, attempted to expunge all psychological notions from economic theory (Lewin 1996; Frey and Benz 2004; Hands 2010). The subsequent application of rational choice theory to most areas of economics such as public choice theory and labor economics, completed the *Paretian turn* of mainstream economics (Bruni and Sugden, 2007; Muramatsu, 2009).[1] On the contrary, non-mainstream economists continued to incorporate ideas from psychology as the works of T. Veblen, J. M. Keynes, T. Scitovsky, H. Simon and others, indicate (Earl, 1990).

Thus, although both physics and psychology had exerted a significant and continuous influence on the development of economic thought, the *Paretian turn* effectively halted any interaction with psychology. Additionally, the previous observations can be used in order to assess the significant resistance of contemporary neoclassical economic theory to accept the findings of the new behavioral economics (Earl, 2016). Therefore, the history of the relation of those two subjects to economics can lead to some potentially useful observations concerning the nature of contemporary neoclassical economics. It will be argued that the relationship of neoclassical economics to psychology is greatly determined by a specific conceptual framework with certain methodological features.

Accordingly, this chapter starts with a brief discussion of the history of the influence of physics on economic thought and continues with an examination of the presence of

[1] The terms "mainstream" and "neoclassical economics" were identical at the time of the Paretian Turn. However, recent literature differentiates between the two, with neoclassical economics being part of, but not exhausting, mainstream economics, which now includes in addition to neoclassical economics, experimental economics, new behavioural economics, game theory etc. (Davis, 2006; Colander et al, 2008; Morgan, ed. 2016).

psychological ideas in leading classical, marginalist and early neoclassical economists. Section four discusses the emergence and the completion of the *Paretian tu*rn which effectively severed the ties of economics to psychology. Section five focuses on some methodological issues arising from the previous discussion; namely, it discusses the negative neoclassical stance towards the rise of behavioral economics and the role of physics influence and formalism in determining the current methodological position of neoclassical economics towards psychological findings. A final section closes the paper.

II. Physics as the Ideal Model of Scientific Inquiry

Classical Political Economy

The great success of the 18th and especially 19th century physical sciences in explaining and predicting a wide range of physical phenomena gave these fields of study enormous status among the academic community and also among the general public. Thus, it is not surprising that the physical science ideal was present even in the writings of many classical economists. In Adam Smith's *History of Astronomy*, the Newtonian system is viewed as the basic conceptual framework for the understanding of the natural world. In Smith's view, the Newtonian method should be followed in every science whether moral or natural (Smith, 1983, pp. 126-34; see also Raphael, 1989; Schliesser, 2005). Another major classical economist, J.B. Say, distinguishes between descriptive sciences (e.g. botany and natural history) and experimental sciences (e.g. chemistry and natural philosophy). Descriptive sciences arrange and accurately designate the properties of certain objects. Experimental sciences unfold the reciprocal action of substances on each other, or in other words, the connection between cause and effect. (Say, 1803, pp.17-18). Political Economy belongs to the experimental sciences

because it demonstrates "the manner in which events take place in relation to wealth." (Say, 1803, p.18).

Jeremy Bentham, the founder of utilitarianism and a major source of inspiration for subsequent economic thought, strongly argued that the principle of utility could serve in social science the role that gravity plays in Newton's model of the physical universe (Gordon, 1991, pp.251-253). In the same spirit, A. Comte provided the methodological justification for a unified social science. In Comte's positivism, social sciences should study social phenomena in the same way that Astronomy, Mechanics, and Biology study astronomical, mechanical and biological phenomena (Bourdeau et al, 2018). Comte's philosophy of positivism had substantial influence on the views of many post-Ricardian authors concerning the nature and scope of economics. For instance, John Cairnes places Political Economy in the same class of sciences with Mechanics, Astronomy, Optics, Chemistry, and Electricity, and, in general, all those physical sciences which have reached the "deductive stage." (Cairnes, 1875, p.35).

J. S. Mill provided one of the first detailed analysis of the method of Political Economy. Although, Mill advocated a separate methodological approach for social sciences, the influence of Bentham and Comte is present in his methodological discussion. Mill believes that Physical sciences like Astronomy are exact sciences while economics like other social sciences is an inexact. According to Mill, economics is a science but it is not as exact as physical sciences (Hausman, 1992, pp.123-33). It is clear, that the physics ideal is present in his extensive analysis of the state and the method of economics as a science (see also Hollander, 2012).

In general, the physical sciences were viewed by many classical economists as the way the new science of political economy should follow. It should be pointed out though,

that they did not adopt the mathematical formalism of physics or astronomy in the study of economic phenomena.

Marginalism and Early Neoclassical Economics

The emergence of marginalism in the 1870's can arguably be described as a scientific revolution in the history of economic thought (e.g. Mirowski, 1984; Screpanti, and Zamagni, 2005; for an opposite view see Blaug, 1972, Meek, 1972). The conceptual shift towards the subjective theory of value, the emphasis on demand-based analysis rather than on supply-based, the systematic use of mathematics, and the central role of the model of Homo Economicus, are the main elements which characterize the marginal school of economic thought. In spite of all those fundamental changes, the scientific ideal of physical sciences was a key common methodological element with the classical school. In fact, the endeavor to imitate the methods of physics became much more apparent with the emergence of the marginalist school. Further, the appeal to physical sciences provided the methodological justification for the increased use of mathematics observed in most marginalist works.

One of the founders of the school, W. S. Jevons states that the theory of economy presents a close analogy to the science of statical mechanics (Jevons, 1871, p.viii). The same thesis is also presented in his subsequent "Principles of Economics", where economic laws are conceived as universally valid like those of physical sciences (Jevons, 1905, p. 198). At the same period, L. Walras' General Equilibrium Theory is the best example of the application of mathematical method in economics. Walras predicts that mathematical economics will rank with the mathematical sciences of astronomy and mechanics (Walras, [1871]1965ed, p.47, 48; see also Turk, 2012). Although he did not advocate the use of mathematics in economics, C. Menger also

thought that economics can be as exact science as the physical sciences (Menger, 1879, p.218).

With the establishment of the marginalist school, the scientific ideal of physics was quite explicit in the writings of leading marginalists. In particular, F.Y. Edgeworth's main work entitled *Mathematical Psychics: An Essay of the Application of Mathematics to Moral Sciences* (1881), represents the height of the physics emulation in the history of economic thought. It also sets the basis for the methodological justification of the use of mathematics in social sciences and especially in economics.

According to Edgeworth, the first argument supporting the employment of the methods of mathematical physics to social science, is based on the assumption that every social phenomenon is the concomitant of a physical phenomenon. For instance, pleasure is the concomitant of energy (Edgeworth, 1881, p.9). Given the close connection of energy and pleasure, the maximization principle is easier to be accepted as a fundamental concept in economics. The second important reason for the application of mathematics to economics, is the quantitative nature of the discipline. Edgeworth argues that the lack of precise numerical data and exact functional relations in economics, is not an obstacle to the application of mathematical methods. He mentions the example of hydrodynamics where the available data is similar to economic data (Edgeworth, 1881, pp.4-5).

The next figure who contributed to the formation of current ideas about method in economics was Irving Fisher who is considered to be one of the most important promoters of marginalism in America. For many historians, Fisher, accomplished the most thoroughgoing mathematization of marginalist theory (Breslau, 2003; Zouboulakis, 2003). The systematic introduction of mathematics into economic theory

was a conscious methodological position of imitating the methodology of classical physics. As an illustration of the correspondence of physical and economic phenomena, Fisher built an elaborate hydraulic machine with pumps and levers, allowing him to demonstrate visually how the equilibrium prices in the market adjusted in response to changes in supply or demand (Fisher, 1892; Tobin, 1985).

Phillip Wicksteed's approach to economics combined the physics methodological ideal with the use of mathematics, albeit not to the same extent as in Jevons' and Walras' works. For instance, he compares the analysis of total and marginal utility to the projection of a body upwards at a given velocity (Wicksteed, 1888, pp. 2−15). In his other major work, Wicksteed (1910) continues the numerous analogies from physics, clearly implying that physics is the ideal model of scientific explanation.

Physics and Neoclassical Economics

After the strengthening of the physics ideal in the works of Edgeworth and Fisher, the increased formalization of economics continued with the seminal works of J. Hicks, R. Allen, P. Samuelson and J. von Neumann. Their main endeavor was to construct a mathematical economic theory so as to make it as 'scientific' as the hard sciences. Hicks and Allen provided a formal model of demand theory which was essentially based on marginalist concepts but was cast in a mathematical framework (Hicks and Allen, 1934). After a few years, the publication of Samuelson's Foundations (1947) was also full of mathematical methods and tools used in physics. Samuelson adopted a conscious methodological stance to model economic analysis to physics. Influenced by physicist Edwin Bidwell Wilson, Samuelson, thought that economics could use the same mathematics as physics without resting on the same empirical foundations and certainties (Samuelson, 1998, p.1376; Backhouse, 2015).

During the same period, John von Neumann's work promoted further the development of mathematics in neoclassical economics. Just as the previous figures, he also advocated and strongly endorsed the use of the methods of physics for economic problems (von Neumann and Morgenstern 1944, pp.3-7). In his writings, physics is always the benchmark for the state and the status of economics and he was confident that the achievement of the scientific status of physics is attainable and only a matter of time (von Neumann and Morgenstern, 1944, p.4).

In one of the most influential essays on economic methodology, Milton Friedman (1953) reinforces the intellectual tradition of physics as a scientific ideal. It is suggestive that in this essay, Friedman also uses the analogy of physical sciences in his effort to construct the methodological basis of positive economics. In his view:

"Positive economics is, or can be, an 'objective' science, in precisely the same sense as any of the physical sciences." (Friedman, 1953, p.4).

The essay is full of analogies between economics and physics (Friedman, 1953, pp. 4, 5, 10, 32, 36). Although Friedman's essay has been the subject of extensive criticism (see for instance, Mäki, 2009), it still shapes current perception concerning the method of neoclassical economics.

In general and by the middle of the previous century, neoclassical economics had reached a high degree of formalism by employing mathematical methods and tools from physics (see also Ingrao and Israel, 1990; Weintraub, 2002). Nowadays, neoclassical economists do not explicitly refer to physics as their methodological ideal. The physics-based conceptual tools of neoclassical analysis are taken as given and as fundamental components of neoclassical theory. Still, one can find influential works where the reference to physics is done intentionally in order to emphasize the scientific character of economics. E. Lazear writes:

Economics is not only a social science, it is a genuine science. Like the physical sciences, economics uses a methodology that produces refutable implications and tests these implications using solid statistical techniques (Lazear, 2000, p.99).

After stressing that the concept of equilibrium is central in economics as is also the case in the physical sciences, Lazear argues that economics is superior to other social sciences because "among social scientists, only economists insist on a physical-sciences-style equilibrium as part of the analysis." (Lazear, 2000, p.101).

III. Psychological Ideas in Economics Discourse

Contrary to the relationship between economics and physical science, the interaction between economics and psychology has many episodes in the history of both fields. Since the 18th century, economists have usually founded their own economic theories on some principles and ideas about human nature; accordingly, economics was not independent from psychological foundations. In fact, before and during the marginalist revolution, there were major authors who attempted to infuse psychological ideas and concepts into economics, and explicitly argued for the necessity of psychological reasoning. As will be seen in more detailed manner, these authors adopted many significant behavioral and psychological assumptions with respect to economic activities, opening the ground for future developments such as the emergence of behavioral and psychological economics.

Classical Political Economy

Adam Smith's thought can be placed in the Scottish Enlightenment tradition. In this conceptual framework, the view of science (which developed mainly under the influence of Hume), was that the study of human nature should be central. Thus, political economy was understood in terms of philosophy and history, and also it was

not seen as separable from the other emerging social sciences (Dow et al 1997, pp.371-373). Thus, it was not surprising that Adam Smith in his *Theory of Moral Sentiments* (1759), dealt extensively with the psychological aspects of choice.[2] It is also well-known that in the *Wealth of Nations*, he regarded self-interest and self-love as the fundamental motives of human motivation and action. However, in his *Theory of Moral Sentiments*, by recognizing the plurality of human incentives, he emphasizes the pleasure of mutual sympathy (Smith, 1759, p.4). Smith's interest in the influence of emotion and sentiment on socio-psychological motivation, "foreshadows a number of areas in modern behavioral economics, particularly models of social influence" (Baddeley, 2013). Furthermore, what is now referred to as 'psychological' was Adam Smith's explanation for the motivation for science and the spread of ideas (Dow, 2010).

The strong tradition of analyzing the psychological elements of human nature continued in the work of Jeremy Bentham. With the spread of Bentham's utilitarianism, the hedonistic psychology entered economic thinking in a systematic way. Bentham puts pain and pleasure at the center of human action which is the basic principle of psychological hedonism (Bentham 1823, p.1). As he states: "They [pleasure and pain] govern us in all we do, in all we say, in all we think: every effort we can make to throw off our subjection, will serve but to demonstrate and confirm it." (Bentham 1823, p.1). The influence of Bentham's thought on subsequent economists was great. The first economists to be influenced by his ideas were the representatives of the late period of the classical school. N. Senior, James and John Stuart Mill, and J. E. Cairnes were the most renowned classical economists who followed the basic principles of Bentham's utilitarianism.

[2] Among the features of the Scottish political economy tradition as summarised in Dow (1987) was the recognition of the sociological and psychological aspects of theory appraisal.

Nassau Senior was very conscious of the psychological bases of economic behavior. He stressed that in order to explain economic behavior we should first examine the various principles and motives that shape human economic action. According to Senior, "the desire for wealth" is considered as the fundamental human motive, since it is "the cornerstone of the doctrine of wages and profits, and, generally speaking, of exchange. In short, it is in Political Economy what gravitation is in Physics" (Senior, 1836, p. 28; see also Karayiannis, 2001).

James Mill, influenced by Hume, Hartley and Thomas Brown and by associationist psychology, argued that the mind is made of only sensations and ideas held together by contiguity (Mill, 1829/1869). Similarly, "for Mill, the mind consisted of mental elements held together by the laws of association; therefore, mental experience was as predictable as physical events." (Hergenhahn, 2009, p.154). Furthermore, both James and John Stuart Mill were influenced by Bentham's utilitarian principles. It is indicative that J. S. Mill describes political economy as a moral or psychological science and defines it as "the science relating to the moral or psychological laws of the production and distribution of wealth." (Mill, 1844, p.129, 133)

Apart from the major authors discussed so far, the psychological bases of economic behavior were a subject that captured the interest of many other significant figures of the classical school. R. Whately, M. Longfield, T. Banfield, R. Jennings and J. Cairnes were some of those figures (see Drakopoulos and Katselidis, 2019),

Psychological Ideas in Marginalists and Early Neoclassicals

As was noted before, a subjective theory of value followed by the gradual formation of a model of individual economic behavior (Homo Economicus), was a key characteristic of the marginal school. The shift towards a utility based theory of value did not emerge

in vacuum, but it was clearly connected to the psychological ideas found in many classical and pre-marginalist economists. In marginalism, the concept of marginal utility was central in the theory of value along with the selfish maximization of pleasure or satisfaction. Most leading marginalists explicitly acknowledged the philosophy and psychology of Benthamite hedonism as their main influence. In this respect, the incorporation of ideas from other intellectual areas was considered methodologically valid and desirable.

One of the protagonists of the first marginalist generation, W. S. Jevons openly admits the influence of utilitarianism when in the introduction of his main work states: "I have no hesitation in accepting the Utilitarian theory of morals" (Jevons, 1871, p.27). Furthermore, Jevons' well-known definition of economics in terms of calculus of pleasure and pain indicates his emphasis on psychological sensations. In a similar vein, Walras conceives all land-owners, workers, and capitalists as pleasure maximizers (Walras 1874, 42-43). Finally, Menger thought that the object of economic research was to discover those laws governing market phenomena which can be traced back to their ultimate genetic determinants in man's physiological, psychological and social nature (Jaffe 1976, p.522).

In his attempt to construct a theory of "psychophysics", F.Y. Edgeworth was keen to incorporate psychological ideas in economic analysis. Similarly to Jevons, psychological hedonism was the underlying framework in Edgeworth's most important work (Edgeworth, 1881). Edgeworth viewed psychological phenomena as a legitimate field for the application of mathematical tools, like, for instance, his willingness to link "hedonic calculus" from psychophysics to "utilitarian calculus" in economics. The aim of a unified science of physical and mental phenomena can be found in his notion of "psychophysics" (for a detailed discussion, see Drakopoulos and Katselidis, 2015).

Wicksteed's main methodological concern was to construct an economic theory free from non-scientific elements. His misgivings about the obvious role of hedonism in marginalist formulations led him to deliberately downplay marginalism's hedonistic underpinnings (see Drakopoulos, 2011). However, he supported the methodological view of incorporating findings from psychology into economics: 'the psychological law that dominates economics dominates life' (Wicksteed, 1894, p. 780). Moreover, he believed that all psychological considerations that bear upon the production and distribution of wealth must be included in economics if it is to become a positive science (Wicksteed, 1894). It must be emphasized here that for Wicksteed, psychology was a legitimate scientific discipline, and he therefore saw no obstacle to economics using its concepts and findings.[3]

IV. The Emergence and the Completion of the *Paretian Turn*

Edgeworth's work can be viewed as the peak of the interaction between economics and ideas from psychology after the marginalist revolution. However, in the closing decades of the nineteenth century when the second marginalist generation of economists emerged, the influence of positivism as the dominant scientific philosophy became much more prevalent (Dow, 2002). One of the basic tenets of positivism was that the enormous success of the physical sciences meant that their scientific methodology should also be followed by the other disciplines (methodological individualism). The application of the methodology of physical sciences to economics, called for the rejection of all normative, ethical or metaphysical elements (for a discussion, see Mirowski, 1989; Dow, 2002, pp.170–175). Due to the influence of positivism,

[3] It is interesting to note that John Neville Keynes writing during the same period, also has a positive attitude towards psychology. In his view, political economy "presupposes psychology just as it presupposes the physical sciences." (Keynes, 1890, p.46).

psychological elements were also considered as value-laden and therefore unacceptable for the corpus of economic theory (see also Coats, 1976; Lewin, 1996). The important consequence of this methodological stance was that many leading economists of the period became indifferent – or even hostile to the findings of other social sciences, and especially to psychological theories.

Vilfredo Pareto was extremely influenced by the prevailing positivist scientific philosophy. His methodological ideal for the discipline of economics was that it should be a mathematical science, part of the natural sciences such as physiology and chemistry (Pareto, 1896, p. 21). In the spirit of positivism, this required that economics should be freed from any philosophical or psychological notions that hamper the application of the positivist methodology[4]. In the same conceptual tradition, Pareto believed that the construction of the fictional model of economic man was adequate for the needs of economic theory, thus clearly implying that psychological findings are not necessary (Pareto, 1907; see also Bruni and Guala, 2001; Bruni, 2010).

Similarly to Pareto, Fisher was against the inclusion of psychological concepts in economics. Fisher thought of psychology as a "soft" subject not worthy for consideration by the "hard" science of economics. In this sense, the following statement is indicative: "But the economist need not envelope his own science in the hazes of ethics, psychology, biology and metaphysics" (Fisher, 1892, p. 23).

The negative attitude towards psychology was further promoted by L. Robbins' influential methodological work in which he supported the view that psychology ought to be kept out of economic analysis (Robbins, 1932, pp.83–84). Regarding the theoretical developments, Pareto's and Fisher's anti-psychology stance resulted in the

[4] For an extensive discussion, see Drakopoulos, 1997.

reformulation of consumer theory as an allegedly psychology-free theoretical construction. The reformulation was completed in the works of Hicks, Allen, and Samuelson, and mainstream economics expelled (at least nominally) any psychological and sociological notions found in earlier marginalist writings (see also Bruni and Sugden, 2007; Hands, 2010). For instance, the main intention of Samuelson's revealed preference theory was to dismiss the alleged psychological concepts of utility theory (Samuelson, 1938; 1947). The tendency to ignore concepts and findings from other social sciences and especially from psychology, continued in the post war era. It was also strengthened by the rise of logical positivism — the modern version of nineteenth century positivism — which became very popular among the vast majority of mainstream economists (Redman, 1993). The influential paper by Stigler and Becker (1977), where they claimed that preference theory can free economics of any need to turn to other disciplines such as psychology, is a representative example of this trend.

The new concept of psychology-free economic rationality would also form the basis of the general equilibrium model that emerged during the same period (Arrow and Debreu, 1954; Arrow and Hahn, 1971). The extension of economic rationality in the form of axiomatic expected utility theory in the works of John von Neumann, Oscar Morgenstern, and Leonard Savage was also in the spirit of independence of any psychic state (von Neumann and Morgenstern, 1944; Savage, 1954). In the middle of the twentieth century, Milton Friedman's (1953) essay on economic methodology can also be viewed as an effort to shield the rationality assumption from criticism mainly originating from psychological research (see also Düppe, 2011). In Friedman's opinion, psychological assumptions were largely irrelevant to the validation of theories (see also

Sent, 2004; Muramatsu, 2009).[5] These developments completed the *Paretian turn* of mainstream economics. Although for a long period in the history of economic thought economists were open to incorporate ideas and concepts from both physics and psychology, the establishment of mainstream economics severed the ties to psychology.

V. Methodological Issues

Psychology and Behavioral Economics

The *Paretian turn* was largely responsible for the break of the long tradition of the interaction between economics and psychology in the framework of mainstream economics. However, non-mainstream economists continued to draw upon psychological concepts, also as part of the criticism of the standard model of economic rationality. Thus and long before the emergence of behavioral economics as a distinct discipline, Herbert Simon criticized the mainstream model of "Homo Economicus" from a psychological viewpoint. By focusing on the behavioral and cognitive processes of humans making decisions, Simon argued that the conception of economic man as a lighting calculator of costs and benefits is unrealistic. The important repercussion of Simon's approach was the challenge of the established model of economic rationality. (Simon, 1955; 1979).[6]

Apart from undermining the standard approach to economic rationality, Simon's work provided the stimulus for further examination of the psychological basis of economic behavior. Thus, in the late 1970s, the theoretical and empirical validity of neoclassical economic rationality as expressed in the expected utility theory, started to be questioned

[5] Friedman's negative stance towards psychology was also the basic reason for his rejection of Duesenberry's "psychology based" consumption function (Mason, 2000).
[6] Hayakawa and Venieris, 1977 provide an early example of how satisficing behavior can be applied to consumer theory.

further by psychologists Daniel Kahneman, Amos Tversky, and Paul Slovic (Kahneman and Tversky, 1979; Kahneman, Slovic and Tversky, 1982). These works are considered to have given the stimulus for the emergence of new behavioral economics (as opposed to old behavioral economics stemming mainly from the work of Simon). New Behavioral economics can be viewed as a systematic attempt towards the revival of psychological ideas in economic analysis (Sent, 2004). Kahneman and Tversky's approach had a strong orientation towards psychology and many key ideas found in new behavioral economics were stimulated by psychological literature. Notions such as reference dependence, loss aversion, adaptation, endowment effects, and framing effects are commonplace in modern behavioral economics (see Rabin, 2002). For instance, Ernst Fehr and Klaus Schmidt acknowledge that their work concerning fairness is connected to the relevant psychological theories: "Our theory is motivated by the psychological evidence on social comparison and loss aversion" (Fehr and Schmidt, 1999, p. 856). Furthermore, some of the more recent models originating from the new behavioral economics draw on explicitly from findings from neuroscience and cognitive psychology (e.g. Camerer, Loewenstein and Prelec, 2005; for a detailed discussion, see also Muramatsu, 2009).

It has to be noted though, that the new behavioral economics do not challenge the standard model of economic rationality. Instead, "the realism of the psychology underlying economic analysis will improve the field of economics on its own terms—generating theoretical insights, making better predictions of field phenomena, and suggesting better policy." (Camerer and Loewenstein, 2004, p.3). In the same vein, R. Thaler rejects the notion that behavioral economics was a revolution in economics and views it as one part of the growing importance of the empirical work in economics (Thaler, 2016). In general though, new behavioral economics represents the main

manifestation of the current revival of the interaction between economics and psychology.

The Legacy of the *Paretian Turn*

Regardless of the increasing presence of new behavioral economics, the negative attitude towards importing psychology into economics is still prevalent among neoclassical economists. There are a number of arguments which have been suggested against the 'psychology inclined' behavioral economics. One view asserts that behavioral findings which undermine the standard model are of little interest, since they correspond to deviations from the rational behavior, and therefore only describe the mistakes the individual can make during this process of "rationalisation" (Binmore, 1999). Another approach rejects the criticisms of the rational choice theory by lab experiments contacted by behavioral economists. According to this view "there are many reasons to suspect that these laboratory findings might fail to generalize to real markets." (Levitt and List, 2008, p.910). Furthermore, it is suggested that agents behave far more selfishly in natural settings than in lab experiments (Levitt and List, 2008, p. 909).

The leading neoclassical economist David Levine focuses on the methodological foundations of behavioral economics. Levine strongly rejects the criticism of the standard theory by behavioral economists. He argues that the connection of behavioral economics to psychology and neuroscience is doomed to fail because the goals of psychologists and economists are different, and that this has implications for importing ideas from psychology into economics (Levine, 2012, p.125). In the same vein, the distinguished philosopher of economics Don Ross argues that economics and psychology are fundamentally distinct disciplines with different methodologies, and

therefore he "rejects the call voiced by some behavioral economists for a revolution in the main methodology of economic modelling and data analysis." (Ross, 2014, pp. 19-20). In general and in spite of the rise of new behavioral economics, there are strong objections by neoclassical economists to incorporate psychological research into economic theory.

Physics, Formalism and Psychology

A number of specialists in economic methodology have maintained that the physics-based mathematical method has become the dominant ideology in the economics academy (e.g. Elster, 2009; Lawson, 2012). In particular and according to Tony Lawson, this ideology consists of "…the extraordinarily widespread and long-lasting belief that mathematical modelling is somehow neutral at the level of content or form, but an essential method for science, underpinning any proper or serious economics." (Lawson, 2012, p.17). In the case of the relationship between economics and psychology, the stance of neoclassical economics towards psychology is still shaped by the *Paretian turn*. One can argue that the *Paretian turn* was the result of the consolidation of mainstream economic methodology: the physics ideal and the ensuing mathematical formalism provided the methodological framework for the establishment of rational choice model[7]. Due to the legacy of the *Paretian turn*, this model is conceived as having no psychological basis, thus isolating neoclassical economics from any meaningful interaction with psychology.

In this framework, one can understand better the failure of Simon's psychological approach to influence standard economic theory (see also Dow, 2010). Similarly, the

[7] It should be noted here that since the mid20th century, the meaning of the term formalism has been associated with the triumph of form over substance rather than the mere use of mathematics (Blaug, 1999). In addition, its modern use has to do with the increasing influence of axiomatic approach in economics as was also the case in the field of mathematics (Ingrao and Israel, 1990; Weintraub and Mirowski, 1994). For an analysis of the changing meaning of the tem formalism, see Milonakis, 2017.

empirical challenge of experimental results supplied mainly by new behavioral economists, have failed to make substantial inroads into neoclassical theory (see also Rabin, 2002). As Sheila Dow notes:

> The empirical results of experimental economics at times seem to falsify key elements of pure theory in mainstream economics. Yet, amending theory in order to take this into account, particularly with input from psychology, has run up against the strictures of mathematical formalism. (Dow, 2013, p.27)

The firmly established conviction of psychology-free economic theory can also be seen as an explanation of the relative failure of the new behavioral economics to infuse psychological concepts into neoclassical economic theory. This is despite the fact that the new behavioral economics does not challenge the basic tenets of the standard model of economic rationality (Sent, 2004). The established methodological framework can also explain the denial to consider the rich contributions of psychological insights of many leading non-mainstream economists. The examples of T. Veblen, J. M. Keynes, T. Scitovsky, and H. Simon are indicative (for discussions see Fiori, 2011; Pugno, 2014; Goodwin, 2016). The common methodological point of these heterodox approaches is the rejection of the standard model of economic rationality. The abandonment of this narrow framework inevitably allows the presence of psychological notions. As Sheila Dow aptly observes:

> But if we depart from the formal requirements of models of optimisation subject to constraints, then a richer notion of psychology, and an integration of cognitive and emotional factors, are possible. (Dow, 2010, p.260)

In sum, the epistemology of neoclassical economics is the key for the understanding of its negative attitude towards psychological ideas.

VI. Concluding Comments

The history of the relationship between physics and economics indicates that since the classical school, physics exercised a very significant influence on the formation of

economic theory and method. The height of this influence was reached with the emergence of marginalism and of early neoclassical economics. The gradual dominance of mathematical formalism, the conception of economics as an exact, positive science, the positive-normative distinction, and the emphasis on prediction, cannot be comprehended without taking into consideration the influence of classical physics. As was seen, contemporary neoclassical economic theory and method still acknowledge their intellectual affinity to physical sciences.

On the contrary, the history of the relationship between economics and psychology has followed a different route. The willingness of classical economists to incorporate psychological ideas was evident. The same observation can be made about the founders of marginalism who often appealed to psychology in order to support the subjective theory of value and also to build a theory of individual economic behavior. Early neoclassicals such as Edgeworth and Wicksteed were also supporters of drawing from psychology. However, the course changed with the emergence of the *Paretian turn*. Initiated mainly by Pareto and completed in the first decades of the 20th century, psychological ideas were deemed to be unnecessary for economic theory. The expulsion of psychology was completed by the influential works of Samuelson and Friedman.

Thus, the relative long tradition of drawing from psychology came to a halt with the establishment of mainstream economics by the mid20th century. Psychology was increasingly viewed as being subjective and ambiguous and therefore unscientific. In contrast, physics continued to be held at high esteem and viewed as a methodological model for economics. The rise of behavioral economics (and especially of the new behavioral economics), with its strong psychological bent, did not end the isolation of economics from psychology. Contemporary neoclassical economic theory is still very

reluctant to allow psychological findings in the core of the theory. The main reason for this, is the dominant methodological framework which is still largely shaped by the lasting influence of the classical physics ideal. Our discussion indicates that the relationship of mainstream economics to physics ultimately constrained its interaction with psychology.

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