

József Móczár

Ergodic Versus Uncertain Financial Processes

Part II: Neoclassical and Institutional Economics

SUMMARY: The science of economics should focus its research on increasing the prosperity and well-being of mankind, wherein priority should be given to the achievement of an equilibrium, the distribution of income, and the understanding of the future. Its objectives include the development of proposals for economic policy to facilitate the harmonious development of both society and the economy. Debated between mercantilists and physiocrats as early as the 17–18th centuries, the role of the market and the government remains questionable to this day. Classical economists relied on a fatalistic intuition in explaining the role of the market, arguing that market mechanisms would automatically create an equilibrium in the long term, regardless of the initial conditions. In the 19th century, Boltzmann put forward a similar principle in thermodynamics: the ergodic hypothesis. In the first part of this article, I reported the research findings that I had made in the project Ergodicity in the theory of finance. Part II offers an analysis of the emergence of neoclassical and institutional economics, their schools, and their differences in addressing ergodicity. Neoclassical economists expanded their unrealistic assumptions further, Samuelson being the first to incorporate the ergodic hypothesis into his model, followed by Black and Scholes, and finally Lucas and Sargent, denying the role of the government. They were opposed by institutional economists, headed by Keynes, who denied that the future would be a shadow of present and past data, arguing that as financial processes were inhomogeneous and their forecasts were uncertain, the government played a significant role. My analyses modernise and complement the Samuelson–Nordhaus family tree of economics. I analyse the citation counts of Nobel Prize laureates in neoclassical and institutional economics based on calculations using a modified Bass model, and compare their counts to those of the main classics. Finally, in reference to Piketty's analyses, I propose the reintegration of the economy and ethics both in research on theoretical economics and in socio-economic practice. Moreover, I propose the development of a new theory on income distribution that follows changes in property rights.

KEYWORDS: ergodic hypothesis, fatalistic intuition, ergodic stochastic financial processes, neoclassical economics, institutional economics

JEL CODES: A1, C1, E2, E5, E6, G1, N0

In this article, I examine ergodicity and uncertainty in forecasting stochastic financial processes and in approximations to reality. I focus on the relevant papers and results produced on the subject, i.e. the papers not cited are either redundant or deal with issues that

follow from the research findings reported in this study.

Neoclassical economists rely on the ergodic hypothesis in examining stochastic financial processes: they consider the future to be predictable as opposed to the institutional school, whose advocates treat the future as uncertain and unpredictable. The former employ

E-mail address: jozsef.moczar@uni-corvinus.hu.

financial econometric methods, mostly with stochastic Newtonian dynamics, to propose theories and models based on abstract, axiomatic and unrealistic assumptions, whereas the latter rely on, besides real institutional assumptions on the economy and society, arguments using the logic of probability based on statistics.

Part II consists of four chapters. Chapter 1 provides a brief analysis on the *laissez faire* principle of classical economics, the debates of *Smith and Ricardo* on the labour theory of value and *Say and Malthus'* subjective theory of value as the kernel of neoclassical economics. The road to Marxist economic theory was paved by Ricardo's theory of value. In the aftermath of the industrial revolution in 19th century England, Marx's *Capital* analysed the situation of the working class based on Marx's law of value, whereas its Leninist, Stalinist and Maoist distortions failed one after the other over the course of the 20th century. In Chapter 2, we examine the emergence and key models of neoclassical economics from the perspective of ergodicity. This school put forward its static models based on abstract assumptions, formalism, and mathematics built on Newtonian mechanics for the momentary interrelations of a parallel world that did not exist in reality. Financial processes are addressed by introducing stochastic Newtonian dynamics and stochastic processes (martingales, geometric Brownian motion, Itô's lemma, etc.). Citing *Móczár* (2008/a), the author shows that the Black–Scholes model, in dynamic programming Bellman's optimality principle and the Bellman equation, and *Lucas's* model based on the hypothesis of rational expectations explicitly rely on the ergodic hypothesis, as a result of which they failed ignominiously in predicting the financial processes of the real world. Chapter 3 describes the evolution of institutional economics and its real and feasible inquiries into reality

(through uncertain financial processes, moral values, etc.), which were supported by conclusions drawn from the logic of probability, the institutional system of the economy and society, interactions between law and economics, regulations, contracts, empirical data, etc. Although this view evolved in the United States in the 1920s in opposition to the neoclassical school, similar principles were also followed by many in Europe. Institutional economics remained dominant in the United States until the 1940s, when European scholars migrating to the United States fleeing fascism took with them their neoclassical works along with European culture and mentality. From then onward, both schools were simultaneously present in the USA as well. I dedicate a separate subchapter to discussing how the institutional economist *Keynes'* fiscal and monetary policy, theory of money, demand-side policy, crisis management, etc. were based on uncertainty. In Chapter 4, I analyse the citation counts of Nobel Prize laureates in neoclassical and institutional economics based on *Offer–Söderberg* (2016). I analyse their assessment using calculations by *Samuel Bjork*, carried out on the basis of an adjusted Bass model (1969). Based on their so-called Arrow index, institutional economists tend to be ranked in the top half of the scale, which appears to confirm the mission of economics as a science. Enormous wealth has been accumulated in the world, only not to increase general well-being: a vast wealth inequality has emerged (*Piketty*, 2014). To reduce that inequality, the author proposes the reintegration of economics and ethics, which had been separated by *Adam Smith* and his contemporaries, the result of which has remained the status quo in economics to this day, particularly in the neoclassical school and in *laissez faire* societies. The major changes in property rights were not followed up by the distribution theory of static microeconomics, wherein profit continues to be maximised on

the returns of capital and labour, resulting in a disproportional distribution theory.

CLASSICAL ECONOMICS

The study of economics dates back to arguments spanning from the reflections and community debates of Greek philosophers, particularly of *Plato* and *Aristotle*, through the theology of the middle ages to 15th-century moral philosophy¹, and started to develop in the 16th and 17th centuries based on proposals by contemporary merchants and advisors, first with mercantilism and cameralism and subsequently with physiocrats who opposed government intervention in the economy. Adam Smith argued that the penetrating spirit of philosophy and observations expanded to economics and trade, as well as to secular “ethical egoism”,² which led to the birth of political economics. It is therefore not surprising that political economics emerged in Great Britain, which, becoming the homeland of capitalism driven by self-interest, also played a dominant role in international trade for more than 150 years. Its debates were centred around free trade and *David Ricardo* is more often remembered for his arguments on comparative cost advantage than for his labour theory of value.

Adam Smith (1723–1790) followed the disputable *laissez faire* principle of free-trade capitalism, arguing that self-interest³ and market competition served the well-being of society.⁴ In his book, Smith (1776) propagated free trade and the mechanism of supply and demand⁵ as opposed to intervention by the government, marking the beginning of *classical economics*, a new name attached to political economics by Karl Marx. Economics is dated as a discipline of science from the publication of that book. Research by Smith also covered the labour theory of value, the

subsequent full development of which is attributable to *David Ricardo* (1772–1823). He claimed that the value, and consequently the price, of the goods produced was determined by the amount of labour invested to produce them. According to Ricardo, the working class did not receive the full value of the goods produced by it, as capital owners only paid workers the amount required for their sustenance and child-rearing. Contrary to Ricardo, Adam Smith argued that labour was a real measure of value only at a low level of societal development; later, he determined the natural value of goods by adding the rent of capital and land to the value resulting from labour. In other words, he construed natural price based on *William Petty*.⁶ According to *Jean-Baptiste Say* (1767–1832), value was not a result of work but of the subjective utility of goods perceived by their consumers,⁷ an argument also adopted later by neoclassical economists. Similarly, *Thomas Malthus* (1776–1834) did not preclude the role of the consumer in determining value and consequently, price; therefore, he also rejected Ricardo’s labour theory of value. Apparently, this theory sparked the most heated debate even among classical economists. In Ricardo’s theory, the part remaining after the payment of wages to workers, i.e. the profit was appropriated by capitalists, which, on grounds of property rights, resulted in a permanent class struggle between workers and capitalists for an adjustment in the payroll-to-gross-profit ratio. This paved the way to Marxist economic theory.

Marxist economic theory

Marxism, as interpreted by *Vladimir Ilyich Ulyanov* (Lenin⁸ 1870–1924) comprised the three areas: Marxist philosophy, economic theory and political theory. This paper is restricted to a brief analysis of economic theory.

Its creator, Karl Marx (1818–1883) provided a synthesis of the existing achievements of classical economics while criticising them based on his own contributions in his book of three volumes called *Capital: Critique of Political Economy*, which has frequently been dubbed as the Bible of the working class. In the first volume, he describes capitalist mode production, in the second, the circulation of capital, and in the third, the process of capitalist production as a whole. He expresses the circulation of commodities by means of the metamorphosis of commodities: commodity – money – commodity; whereas his general formula for capital is money – commodity – money+profit. Marx developed his *labour theory of value* by reference to Ricardo’s theory: in his theory, the source of value is the use-value of labour. A capitalist purchases labour at its value, and acquires the right to consume it by hiring a worker for 10 hours, whereas a worker produces the cost of his daily necessary means of subsistence (necessary labour) in 5 hours, and the remaining 5 five hours (surplus labour) represent unpaid surplus produce, i.e. surplus value. The value of a commodity is the sum of constant capital (c), variable capital (v) and surplus value (m). The m/v ratio stands for the rate of surplus value, in our example $5/5 \times 100 = 100\%$. Surplus value will increase as the working day gets longer (absolute surplus value), or as the necessary labour shortens (relative surplus value). In the second volume, for the purposes of an analysis of simple and expanded reproduction, social production is subdivided into two “departments”: means of production and articles of consumption. In the third volume, Marx examines the development of the profit rate based on his law of value. Contrary to classical economists, he carries out his analysis on the social economy as a whole rather than on individuals. The profit rate is the ratio of surplus value to the total capital invested in the company, $m/(c+v)$,

where the surplus value m comprises profit, interest and the rent of land. The size of the profit depends on the organic composition of capital (c/v); a high organic composition will produce a lower-than average profit, and a low organic composition will produce a higher-than average profit. As a result of the competition for profit, the free flow of capital between sectors of production will equalise the profit rate across sectors at an average level, leading to a production price derived as fixed capital plus average profit. Consequently, prices will deviate from values; however, the total value of all goods will be equal to the sum of all prices. Marx also noted that where constant capital (c) grew at a faster rate than variable capital (v), the productivity of labour would increase, which would in turn cause the profit rate to fall, ultimately leading to the apocalypse of capitalism.

Marxist economic theory is the only stream of economics that was tested in full, i.e. together with Marxist philosophy and political theory, in the Soviet Union established in 1917, in the authoritarian Leninist–Stalinist regime of socialism, which subsequently underwent a number of reforms until the Soviet Union disintegrated on 31 December 1991, also marking the collapse of the failed varieties of Marxism: Leninism, Stalinism and Maoism.⁹ By contrast, the welfare version of social democracy has prospered or is prospering in a number of Western countries (Sweden, Netherlands, Germany, etc.) as the economic policy of governing parties.

The division of classical economics: neoclassical economics and institutional economics

In the last third of the 19th century, classical economics was divided into neoclassical economics and, emerging somewhat later, insti-

tutional economics. In my interpretation, the difference between the two is best determined by the effective applicability of their results in theoretical economic policy and/or practice. In other words, by the extent to which their theories and models are based on real assumptions about contemporary economy and society, or on abstract, axiomatic or even unrealistic assumptions. The former is represented by institutional economists including *John Maynard Keynes* and his followers, and the latter by the proponents of the marginal revolution serving as the basis for neoclassical theory, and their followers with neo-positivism and, as appropriate to their era, *David Hilbert's* formalism, Bourbakian mathematics, the econometrics of the Cowles Commission and the new methods of mathematical economics, particularly systems of stochastic dynamics. Now that we have become familiar with the concept of ergodicity, the above distinction can also be made on the grounds that institutional economics is concerned with financial and economic processes that are assumed to involve uncertainty, and neoclassical economics with processes that are assumed to involve ergodicity, i.e. while the former considers the future to be uncertain and unpredictable, the latter accepts the ergodic nature of economic processes, and consequently the predictability of the future.¹⁰

NEOCLASSICAL ECONOMICS

Neoclassical economics is the intellectual product of the last third of the 19th century and of the 20th century, which, based on abstract assumptions, formalism, and mathematics, built on Newtonian mechanics, researched and modelled the momentary interrelations, then the deterministic and stochastic dynamics of a parallel world that did not exist in reality. We will see that adopting

the liberal *laissez faire* philosophy, neoclassical economics developed in the footsteps of the latest results of physics and mathematics.¹¹ The core of the formulation of their questions was provided by the essence of classical economics for further analysis exploiting the latest results of contemporary mathematics and physics; in that sense, these formulations are merely arrangements for new instruments, like Mozart's Haydn transcripts. However, in a part of the developed Western world the intellectual market is attaching the highest price to the consistent achievements of the human intellect in this field, and awards the Nobel Prize for those achievements, despite the fact that the relevance of the elegant theories of this school is questionable due to their unrealistic assumptions and neo-positivist formalisations.¹² Their contribution to the well-being of mankind is debatable, and indeed, in some cases their application has led to the global economic crisis.¹³

The marginal revolution

The birth of neoclassical economics can be linked to the work of three authors of the marginal revolution¹⁴ contemplating independently of one another: the English *William Stanley Jevons* (1835–1882), the Swiss *Leon Walras* (1834–1910), and the Austrian *Karl Menger* (1840–1921). Obviously, their contribution may be given different assessments, to such an extent that if the hard core of marginalism is considered to be the metaphor of Newtonian physics, then Karl Menger must be excluded.

Alfred Marshall

Just as classical economics was shaped into a coherent system by the Scottish Adam Smith

(1776), the achievements of the marginal revolution were integrated, through the intermediation of the Swedish *Knut Wicksell* (1851–1926), by the British *Alfred Marshall* (1842–1924).¹⁵ Contrary to *Say's* thesis on the law of the markets, the marginal approach emphasised the effect produced by the factors of demand (consumption) instead of the supply (production) oriented attitude of classical economic theories.

The French Jean-Baptiste Say stated his renowned thesis “The Law of the Markets” in his 1803 Treatise:

“It is worthwhile to remark that a product is no sooner created than it, from that instant, affords a market for other products to the full extent of its own value. When the producer has put the finishing hand to his product, he is most anxious to sell it immediately, lest its value should diminish in his hands. Nor is he less anxious to dispose of the money he may get for it; for the value of money is also perishable. But the only way of getting rid of money is in the purchase of some product or other. Thus the mere circumstance of creation of one product immediately opens a vent for other products.” (Say 1803, p. 167).

Through his interpretation of *homo oeconomicus*, whose decisions on consumption are founded on marginalia and whose evaluation of goods are based on the subjective theory of value,¹⁶ he made a major contribution to the birth of the neoclassical paradigm.

The foundations of the early theory of neoclassical economics were adopted from mid-19th-century physics, the two favourite metaphors being the rational mechanics of the balance of moments, and the mathematical relationships between the orbits of heavenly bodies. Utility was defined as being identical with energy. Research by *Philip Mirowski* (1984) confirms that Walras showed no signs of understanding the physical metaphor, and that he also applied the mathematical tech-

niques and metaphor mechanically, without any imagination. Being even less of a mathematician, Jevons primarily focused on the economic meaning of the energy metaphor. It was Marshall who, while understanding the energy metaphor, also argued that physical interpretation was separable from mathematical technique.

For the most part, Marshall’s (1890) research methodology was already purely theoretical *deductive argumentation* based on the proposition of formal logic that by making a true assumption and interposing valid operations, one will always arrive at a true conclusion. That is, mathematical deduction is merely a kind of logic, namely the logic of theoretical necessity. This was the very inverse of the view held by *John Stuart Mill* (1806–1873), who argued that the empirical content of mathematics was provided by inductive empirical generalisations through the use of the entire toolkit of logic, and that a significant part of evidence was empirical and was based on counting.

In contemporary terms, Marshall was primarily concerned with the questions of microeconomics, as he was opposed to inquiries into the economy as a whole. Contrary to classical economists, he stressed that the price and output of a commodity were determined by both its supply and its demand, and that similar to a pair of scissors, the intersection of the two curves marked the point of equilibrium. He is credited with the price elasticity of demand (*D*) expressed as a logarithmic derivative $d[\log D(p)]/d(\log p)$, which shows the sensitivity of buyers to price.

Neoclassical methodology embraced the assumption that the factors of production were independent of one another. A unit of increase in each factor will result in decelerating growth in output (*diminishing marginal utility*), while the rest of the factors of production remain unchanged (*ceteris paribus*

principle). In this way, Ricardo's principle of scarcity was extended to the realms of capital and labour, thereby contradicting the *increasing returns* characteristic of industry. While there was consensus among the marginalists on the relationship between price and the quantity sold, there was a sharp division of opinion as to whether demand was determined by prices, or *vice versa*, prices were influenced by the quantities present in the market. While following *Antoine Augustin Cournot's* 1838 paper,¹⁷ Walras considered prices as independent variables and quantities as dependent variables, Marshall reversed the direction of the relationship, and considered prices to be the dependent variables. In graphical representation – similar to Walras's price theory – Marshall measured quantities on the horizontal axis, and price on the vertical axis. Falling prices would drive demand, and rising prices would increase supply. The intersection of the two curves would mark the point of equilibrium,¹⁸ the stability analysis of which is left to the reader. In the following we address major neoclassical models and theories.

Frank Plumpton Ramsey's model

In his paper *A mathematical theory of saving*, *Frank Plumpton Ramsey* (1903–1930) added a number of new conditions to those proposed by Alfred Marshall. These were the following: the two-factor production function is directly invariable in terms of time, i.e. there is no technological progress, no decrease in the value of capital, the population is stationary, there are no overlapping generations, all generations are of the same size, and Bentham's equal capacity for enjoyment applies. Ramsey (1928) was concerned with the issue of intertemporal resource allocation through a continuous treatment of time, i.e. how to allocate

the national product between consumption and savings (investments) at any point in time to ensure that the growth in production and consumption would maximise the aggregate utility of consumption over the period under review. The model was Keynes's idea, who argued that more savings today would result in more consumption tomorrow. That is, under the Keynes–Ramsey rule, the cost of postponing today's consumption should be offset against the utility derived from consumption tomorrow. Intermediated by *Edmund S. Phelps* (1961), the Keynes–Ramsey rule became central to the golden rule of capital accumulation. With the adjustment of some of its strict conditions, the model served as a point of reference for Samuelson's (1958) model of overlapping generations, to some degree, for Solow's neoclassical growth model,¹⁹ for the optimising representative agent model, etc. While *David Cass* (1965) increased labour at a constant rate and introduced time preference and the Inada conditions, he also disregarded technological progress, transforming the original Ramsey model into one of optimal governance.

David Hilbert's axiomatic theory

In the meantime, a new challenge to neoclassical economists was posed by *David Hilbert's* (1862–1943) axiomatisation theory, which triggered the formalisation of not only mathematics, but also of economics, proposing a “*key to new scientific research*”.²⁰ Formalism was introduced to economics in Vienna in the 1930s through the demonstration of the existence of the competitive equilibrium put forward by *Abraham Wald* and *John Von Neumann*. That is, general equilibrium theory and consequently also neoclassical economics were shaped by Hilbertian formalism, whose birth in Vienna was assisted by Hilbert's

young colleague Von Neumann, who promoted new ideas by replacing the old deterministic mechanical point of view with one that was based on the concept of mathematical analogy. The quasi-stationary growth model proposed by Von Neumann (1945) broke with the liberal economic ideology that was based on Jevons' utility and self-interest, and also abandoned Newtonian mechanics and marginalism. In this sense, it cannot be classified under neoclassical models, which is why Von Neumann had not been admitted to the circle of western economists adopting the liberal ideology. The reason for his inclusion here is that his model provided the foundation for the Arrow–Debreu (1954) general equilibrium model, which was formulated with the rigour of Bourbakian mathematics.²¹

The Arrow–Debreu model

The Arrow–Debreu (1954) model is the axiomatic analysis of modern equilibrium theory, which provided evidence for the existence and *Pareto* optimum of competitive equilibrium under general and abstract conditions. It belongs to the family of *ex ante* models, which are normative in nature and follow the principle of a hypothetical and deductive approach to logic. The authors describe their theories at the level of functional analogy, but the phenomena (variables, parameters) involved are *a priori* and not empirical categories, without any reference to reality.²² Their various possible solutions may only be construed within their abstract models, the key criterion of their validity being the consistency of internal logic, the “theoretical clarity” characteristic of Bourbakism, which is ensured by axiomatic formulation so that the empirical testability of their correlations is not a necessary requirement. As the model is static, ergodicity is out of the question.²³

The stochastic revolution

In the 1930s, the theory of relativity and quantum theory questioned the theories of classical mechanics, the Newtonian metaphor and the deterministic models, leading to the stochastic revolution. *Ragnar Frisch* laid the foundations of econometrics, while the probability theory proposed by *Trygve Magnus Haavelmo* (1944) bridged the gap between “theory and measurement”, demonstrating that hypotheses may also be confirmed through empirical observations. After 80 years, he succeeded in winning acceptance in neoclassical economics for the epistemological probability theory put forward in Jevons' masterpiece published in 1874, *The Principles of Science*, which essentially formulated the philosophy of maximum likelihood. Since its establishment in 1932 to date, the Cowles Commission²⁴ has been a hub of research on econometric and stochastic processes. This research has produced the most diverse estimation procedures from panel models through structural micro- and macroeconomic models to today's latest achievements including the theory of cointegration and autoregressive conditional heteroskedasticity (ARCH), financial econometrics, dynamic stochastic general equilibrium (DSGE) models, and stochastic processes. Since Haavelmo's revolution, time series in economics have been considered as specific realisations of stochastic processes,²⁵ sharing either of two central features: non-stationariness and time-varying volatility. The former is characteristic of aggregate variables such as gross national product, consumption and employment, which may be assumed to have been generated by non-stationary processes, and to follow stochastic trends, i.e. a random walk. The latter feature is characteristic of financial time series, with banks carrying out volatility estimations as part of their Value

at Risk (*VaR*) analysis. The introduction of special stochastic differential equations and stochastic processes (martingales, geometric Brownian motion, Itô's lemma) bring major changes to even relatively simple deterministic relations in economics. The Black–Scholes (1973) model was one of the first to revolutionise financial markets and financial theory,²⁶ which has been utilised in option pricing. The model explicitly applies the ergodic hypothesis in determining the value of an option. Finally, mention should be made of dynamic programming, where a central role is played by Bellman's optimality principle and the Bellman equation, which themselves are dominated by the ergodic hypothesis. For more details on the methods and models of the stochastic revolution, see Móczár (2008/a, pp. 173–231).

Rational expectations hypothesis

From the 1980s onward, neoclassical economists developed the hypothesis of rational expectations *vis-à-vis* Keynesian demand-side economics to demonstrate the damage resulting from government intervention in market processes. Old-school classical economists explained protracted unemployment by the inelasticity of wages and prices. They ignored the future on a large scale, which is why they accepted government intervention as a guarantee of employment. However, if everyone were to have perfect information on future events (argued the neoclassical school), prices and wages would instantly adjust to the new conditions as the latter would already be known. That leaves no chance of deviations from long-term real values, not even for the short term. Given that economic participants are always in preferred situations, the government's efforts to improve their position will be ineffective.

The rational expectation for any variable X_t is defined by its conditional expected value of probability:

$$X_t^e = E\{X_t | \Phi_{t-1}\},$$

where X_t^e is the conditional expected value of variable X_t subject to the condition Φ_{t-1} , i.e. the set of information available in the period $t-1$. That is, rational expectations are explicitly built on the ergodic hypothesis. On that point, *Skidelsky* (2009, p. 34) argues that the universe is stable over time, allowing the future to be expressed in terms of the past.

According to Lucas's aggregate supply function,²⁷ actual income (y_t) is the sum of nominal income (y^*) and the difference between the actual and expected price levels ($p_t - p_t^e$) multiplied by a positive factor δ . As the expectation is rational, the actual price level must be equal to the expected level, and consequently actual income must be equal to nominal income. Random deviation is expressed as an additional probability variable ε_t , whose expected value is zero. Lucas's neoclassical approach can be adapted to express developments in the inflation rate, then applying Okun's law, a neoclassical interpretation of the long-run Phillips curve is obtained, where the actual inflation rate (π_t) equals the sum of the expected inflation rate (π_t^e) and the difference between the natural unemployment rate and the actual unemployment rate multiplied by μ/δ , $[\mu/\delta(u^* - u_t)]$, where $\mu > 0$. As with income, there may only be a random difference between the actual inflation rate and the rationally derived expected inflation rate, and consequently there may only be a random difference between zero and the difference between the unemployment rates; therefore, the right side of this equation will also incorporate an additional probability variable ε_t , whose expected value is zero.²⁸ Within the meaning of this deduction, if accepted, it makes no sense

to implement an economic policy measure that aims to reduce unemployment. Similar deductions will produce the neoclassical theorem on the neutrality of economic policy, which asserts that systematic monetary policy will have no effect on the real processes of the economy.

Lucas came under heavy criticism for the inability of the rational expectations theory to predict the global economic and financial crisis of 2008–2009. In 2011, in a panel discussion²⁹ Lucas admitted that his paper on expectations and the neutrality of money was only an experiment on the positive theory concerning the Phillips curve. That was essentially what had failed. He sought to explain price stickiness through his model, but he was unable to do so, and could not find a satisfactory solution to the problem. “*There’s a lot of bad models out there. I authored my share,*” Lucas said in a self-critical comment. The question, raised in the same panel discussion, is whether behavioural economics or psychology provide a useful and viable alternative to rational expectations.

INSTITUTIONAL ECONOMICS

The opposition to the neoclassical school manifested itself in the theories of institutional economics, which was announced by *Walton Hamilton* at an American Economic Association conference session in 1918. Its establishment marked a somewhat delayed response from the other branch of classical economics to neoclassical economics. This branch also relied on the theories of classical economics; however, while the neoclassical school used the latest achievements in physics and mathematics to rearrange the theorems and models stated under abstract and unrealistic conditions (ergodic processes, diminishing returns in industry, etc.), institutional

economics continued to address realistic phenomena (financial processes with uncertain outcomes, moral values, etc.) by means of logical conclusions, mathematical and statistical calculations, and empirical data. Based on their assumptions and research, it is obvious that only the achievements of the latter branch can be used for economic policy analysis and economic governance.

Institutional economics emerged in the United States in the 1920s; at the time *Wesley C. Mitchell* was considered to be its leader. The group included *Carl Snyder*, *Irving Fisher*, *Charles Rist*, etc., who were fiercely opposed to the teachings of the neoclassical school, but agreed to the use of mathematical and statistical methods. (On the merit of his work, John Maynard Keynes may also be classified into this group, and will be discussed in specific detail). American economics was dominated by institutional economics at least until the 1940s, when extremely prominent European scholars migrating to the USA fleeing fascism took with them *laissez faire* and English classical and neoclassical works, as well as European culture and mentality.³⁰

Walton Hamilton (1919, pp. 309–311) argued that institutional economics alone was capable of integrating economics, showing how components of the economic system were related to the whole. Additionally, he stressed that institutional economics was not defined in normative terms. He attached importance to the institutional system of the economy and society, the relations between law and economics, regulations, contracts and trust.

Hodgson (2000) lists the following generally accepted propositions for the expansion of the latest institutional research. 1) Although institutional economists insist on giving practical relevance to their theories, their research is independent of any policy proposals. 2) Institutionalism makes extensive use of the achievements of psychology, sociology and

anthropology for a richer analysis of human behaviour. 3) A major task for economists is to study institutions and the processes of institutional conservation, innovation and change. 4) Institutionalist research is concerned with an economy that is situated in a natural environment and is an open and evolving system affected by technological changes, and embedded in a broader set of social, cultural, political and power relationships. 5) Through “reconstructive downward causation”, institutions affect individual participants in fundamental ways.

Prominent modern institutional economists include *John Maynard Keynes*, *Gordon Tullock*, *John Kenneth Galbraith* (1989), *Shigeto Tsuru* (1993) and the Nobel laureates: *Milton Friedman*, *Franco Modigliani*, *Gunnar Myrdal*, *Gary S. Becker*, *James M. Buchanan*, *George Stigler*, *Robert F. Fogel*, *Douglass C. North*, *Leonid Hurwicz*, *Elinor Ostrom*, *Oliver E. Williamson*, etc.

Keynesian economics

The entire school is composed of the theories of John Maynard Keynes. Neoclassical economics is dominated by scarcity, the neutrality of money, equilibrium and unrealistic assumptions, all of which were opposed by Keynes. He contested the Newtonian schema, the concept of mechanical equilibria, and that people were snooker balls whose positions and velocities could be determined accurately. With him, Smith’s invisible hand of the market was replaced by pragmatic and perceptible conventions accompanied by the intentional behaviour of rational people. The direct relationship between individuals’ behaviour and the assumptions of physics about scarcity was seen as intermediated by institutions. Contrary to fatalists, he interpreted equilibrium as “bootstrap” equilibrium, where stationarity

states are the results of the state of expectations. He considered economics to be a moral discipline with its own introspections and values, focusing on motivations, expectations and psychological uncertainties. Although he was mentored by Marshall, Milton Friedman was wrong in claiming that Keynes’ methodology was truly Marshallian;³¹ while Marshall’s logic was deductive in his inquiries, Keynes’s was inductive. Keynes studied mathematics at Cambridge and also passed the Tripos; however, he did not sacrifice reality for the sake of mathematics, because he considered its models useless for economic policy. He was the first to introduce money into economic analyses on the assumption that economic processes were not homogenous (as opposed to the neoclassical argument), which occupied a central role in the Keynesian renewal and revolution of economics: “*A monetary economy, we shall find, is essentially one in which changing views about the future are capable of influencing the quantity of employment and not merely its direction.*” (Keynes, 1936, Preface, VII).

In Keynes’s theory, uncertainty is generated by the capitalist system; consequently, savings are liquid, investments are volatile, the interest rate does not equate savings and investment, and the accumulation of wealth is the source of economic and social instability.³² These findings remain valid even today. Another “core” of his theory is the rejection of Say’s law of the market. Keynes showed that in a monetary economy people tend to accumulate money rather than purchasing real goods. At the same time, the accumulation of money reduces demand, which in turn leads to severe recession.

With Keynes, the aggregate demand function is determined by the sum of the demand for consumption and investment, consumption being a stable component, and investment an unstable component of demand. The former is largely dependent on conventions,

and the latter on expectations. Classical economists proposed an accurate actuarial calculation for the assessment of risks. By contrast, Keynes considered the adoption of certain *conventions*, e.g. the present as a much more reliable reference for the future than the past, acceptance of the behaviour of the majority or the average (herd instinct), etc. He developed the theory of conventional expectations, which is acceptable on the grounds of our limited knowledge of the future.

“The market will be subject to waves of optimistic and pessimistic sentiment, which are unreasoning and yet in a sense legitimate where no solid basis exists for a reasonable calculation.” (Keynes, *Collected Writings*, X, pp. 446–447).

Keynes’s psychological law describes the interaction between income and consumption: when income increases, consumption will grow at a slower rate, and when income decreases, it will also fall at a slower rate. That is to say, consumption is more stable than income. In a growth economy, the gap between the two ought to be filled by investment if the objective of full employment is pursued. Classical economists argued that people were only saving in order to invest, which would not affect the level of aggregate demand, only its composition. By contrast, with Keynes only a part of such savings was intended for investment; the rest created demand for money, which render the prospects of the investment more uncertain. The more society saves, the more difficult it is to maintain full employment. It was therefore expenditures and not savings that resulted in output and employment, and when expenditures fell short of income, Keynes explained, the result was unemployment.

Classical economists considered the interest rate as the factor balancing the supply of savings and the demand for investments. Where the former was higher than the latter, the

interest rate is expected to fall. By contrast, Keynes argued that the effect of the interest rate was greater on investments than on savings. The interest rate is the price that equates the wealth to be held in cash to the available quantity of cash. The greater preference people have for liquidity, the higher the interest rate they would charge for parting with their money. Failure to realise the expected profitability of investment would lead to increased preference for liquidity, placing an upward pressure on interest rates when they should be on the decline.³³ The logic of the *General Theory* culminates by demonstrating that the interest rate may remain above the expected return on capital, which is required to ensure full employment.³⁴

The uncertainty of the future return on investments created the stock market that cuts the risk of an investment through additional investments and is fixed for the firm and liquid for individuals. Stock prices may provide an investor with a certain amount of confidence, which may reduce his uncertainty. With Keynes, the psychology of a stock market panic shows the paradox nature of financial innovation: *“By making investment more ‘liquid’, the stock market reduces the proportion of the resources that people will want to hold in cash. [...] But by the same token it enlarges the scope for speculation and thus makes economic life more volatile”*. Keynes compares the speculative character of stock market investment³⁵ to casino operations, and considers it to be harmful to economic development.

But what led to Keynes’s *General Theory*?, we may ask. The simple answer is that he was in the right place at the right time, and this was coupled with his excellent talent. At Cambridge, he was supported and mentored by no less a personality than Alfred Marshall. He attended the Paris Peace Conference concluding World War I, and considered the Versailles Peace Treaty to be inequitable amid

concerns that it might lead to another world war (which it did). In his book, Keynes (1919) expressed his disapproval of the Treaty, which earned him worldwide fame at a young age. His professional activities confirm that “[i]t is only by argument, by conflict if you like, that economics makes progress”. The role of the market and the state in economic governance was the subject of a heated debate of a quarter of a century between the liberal *Friedrich A. Hayek* and the conservative Keynes. The Great Depression of 1929 was also a new challenge for Keynes, only to confirm his understanding that the discipline of economics ought to focus its research on the prosperity of mankind and the increase of its welfare. He possessed a prodigious flair and talent not only for matters of theoretical economic issues, but also for the application of social science, which was first discovered in him by Marshall.

Keynes challenged Marshall’s teaching that over time the economy would reach full employment in an equilibrium. He argued that the government would have to increase employment through public work programmes such as road constructions, as well as tax cuts, loans, etc. He also held a firm position on the issue of the exchange rate, claiming that if the exchange rate of the British pound sterling were to be fixed at its pre-war level, the result would be massive deflation, falling wages and a deteriorating standard of living, whereby mining, for instance, would lose its competitiveness in the world. The return to the gold standard was disastrous and resulted in a crisis, and the British pound’s peg to bullion was not removed until 1931. To link currencies, Keynes proposed a supranational central bank, where, instead of gold, the exchange rate of each currency would be pegged to a basket of 60 commodities circulating in international trade, with deviations capped at $\pm 2\%$ per annum. Following up on that proposition, in 1944 the Bretton Woods ex-

change rate system was established, wherein the exchange rate of each currency was tied to the US dollar, and through the dollar to gold. Subject to certain conditions, Keynes did not consider planning to be a risky proposition either. Keynes (1926) proclaimed the end to *laissez faire*, arguing that on the grounds of self-interest, businessmen would provide for the public good by pursuing their own profits.

The Keynesian revolution scored a success in the United States: in 1937 the US economy was plunged into recession by *Roosevelt’s* measures, and was saved by Keynes’s proposals. Keynes’s death in 1946 did not affect the triumphal march of the Keynesian revolution. The New Bill of Rights (1943) and the Full Employment Bill (1945) were 100 per cent inspired by Keynes. During *Eisenhower’s* presidency, minor recessions were remedied by means of social transfers and unemployment benefits, a fiscal deficit, and large-scale motorway constructions. Kennedy was the first US president to have adopted a Keynesian economic philosophy: he began his term by cutting taxes, which was also followed by *Lyndon Johnson*. As the Keynesian remedy built success upon success, in 1965 Keynes was named man of the year by *Time Magazine*.

Granting civil rights to Afro-Americans and the introduction of the Medicare and Medicaid health insurance schemes sent US welfare “to the heavens” in the 1960s (Johnson lost due to the War in Vietnam). *Richard Nixon’s* first measure was to cut expenditures, but subsequently he was forced to back down: he abandoned the convertibility of the dollar to gold while devaluing the dollar, introduced tax cuts, increased expenditures, and granted cheap credit to save Lockheed. In 1973–74, OPEC quadrupled the price of oil, which resulted in zero growth and high inflation (stagflation). *Gerald Ford* inherited high unemployment and high inflation, which contradicted Keynes’ theory that it was not possi-

ble for both to increase at the same time. The time had come for a radical reassessment of Keynesian economics.

The process was led by Milton Friedman, who observed during his studies of cycles that the quantity of money had exploded before each downturn. Had the Fed increased the quantity of money through rate cuts between 1929 and 1933, the recession would only have lasted for a few years. Friedman (1968) proposed the strict control and slow growth of the quantity of money, which subsequently came to be referred to as *monetarism*. He argued that an economy in a severe crisis needed an adequate – but not disproportionate – quantity of additional money, rather than additional demand. Setting the quantity of money at the right level would create a “natural level of unemployment”, which may or may not correspond to full employment; nevertheless, an excessive or insufficient quantity of money in the system would certainly lead to unemployment or drive inflation.

Hayek's theory was adopted by *Margaret Thatcher* in the UK and by *Ronald Reagan* in the US, with succeeding presidents alternately following economic policy guidance by Keynes, Hayek, and Friedman. Since the failure of Lucas's rational expectations theory in resolving the 2008 crisis, we have seen a revival of Keynes's theories, which shows the strength of Keynesian economics in explaining the way in which market economies may remain functional over the long term.

Heterodox economics

All we know of this school is that it is characterised by pluralism, it is opposed to neoclassical economics and it is partly institutional, covering, for example, evolutionary, ecological, feminist and unorthodox trends. Its main representatives include *Carlota Perez*, *Thor-*

stein Veblen, *Michael Kalecki*, *Piero Sraffa*, *Joan Robinson*, *Joseph A. Schumpeter*, *Tibor Scitovsky*, *Jinkichi Tsukui*, *János Kornai*, *Ho-Joon Chang*, and the Nobel laureates: *Wassily W. Leontief*, *Joseph Stiglitz*, *Amartya Sen*, etc. However, this school is yet to mature, and is waiting for a contemporary Alfred Marshall or Adam Smith to forge it into a coherent system.

I have updated the Samuelson–Nordhaus (1995) family tree of economics in terms of ergodicity and uncertainty, which is provided in the Annex.

CONCLUSIONS AND LESSONS LEARNED

The acceptance of the ergodic hypothesis is the latest unrealistic assumption of neoclassical economics.

The achievements of individual economists are rated in a great variety of assessment systems. Of those systems, being awarded the Nobel Prize in economics has the highest prestige among today's scholars. Economists have been awarded the Nobel Prize since 1969.³⁶ In awarding the prize, the achievements of Nobel laureates to date have not always confirmed the mission of economics, i.e. that its achievements should serve the prosperity of mankind and increase its well-being. To date, representatives of neoclassical economics and institutional economics have been awarded in roughly equal numbers.³⁷ Samuel Bjork (Offer–Söderberg 2016, pp. 125–148) assessed Nobel Prize laureates in economics based on JSTOR citations of their papers before and after being awarded. The cumulative citation curve is similar to a logistic curve, and the bell-shaped discrete citation curve usually reaches its peak at the inflection point of the cumulative citation curve, where the convex section becomes concave. The citation curve

of Paul A. Samuelson, one of the most prolific Nobel Prize laureates in neoclassical economics, is a typical bell shape, with the number of citations rising to the maximum, and subsequently falling. The Nobel Committee generally nominates scholars near the peak of their citation count, i. e. when they are the most frequently cited and the most renowned.

The assessment of Nobel Prize laureates was topped by Friedman and Arrow, with an index 25 times that of the lowest-scoring Kantorovich. The most controversial Nobel laureate in economics was Hayek, who shared the prize with Gunnar Myrdal. By contrast, Joan Robinson and James K. Galbraith, and at least another 10 nominees, were not awarded the Nobel Prize despite the fact that in Bjork's list Robinson would have ranked 11th from the top, and Galbraith 14th. Their case exemplifies the ideological rigour of the Nobel Committee: Robinson had just turned to heterodoxy when he was nominated; moreover, he was deeply sympathetic to student radicalism, China and North Korea. Galbraith was rejected by Assar Lindbeck³⁸ for being a social essayist, whose alleged marked focus on economic history resembled that of Myrdal, without the originality and depth of the latter. That did not stop Wassily W. Leontief, Bertil Ohlin, Richard Stone and William Vickrey from becoming laureates despite their extremely low Arrow indices. The most memorable blunder of the Nobel Committee was awarding the prize to *Robert Merton* and *Myron Scholes* on one occasion, and to Robert Lucas on another. The first two developed the theory of efficient financial markets, and Scholes also co-authored the Black–Scholes option pricing model, the application of which in the operation of the LTCM hedge fund failed ignominiously one year after the Nobel Prize was awarded to Merton and Scholes, leading to the collapse of the fund. Awarded the Nobel Prize in 1995 for his laud-

ed rational expectations theory, Robert Lucas saw his theory become another resounding flop for its failure to predict the 2008 global financial and economic crisis, which Lucas himself was forced to admit. The prestige of the Nobel Prize in economics was severely damaged by these incidents, as well as by the extremely harsh criticism voiced publicly by certain Nobel Prize laureates on the achievements of fellow laureates in economics.

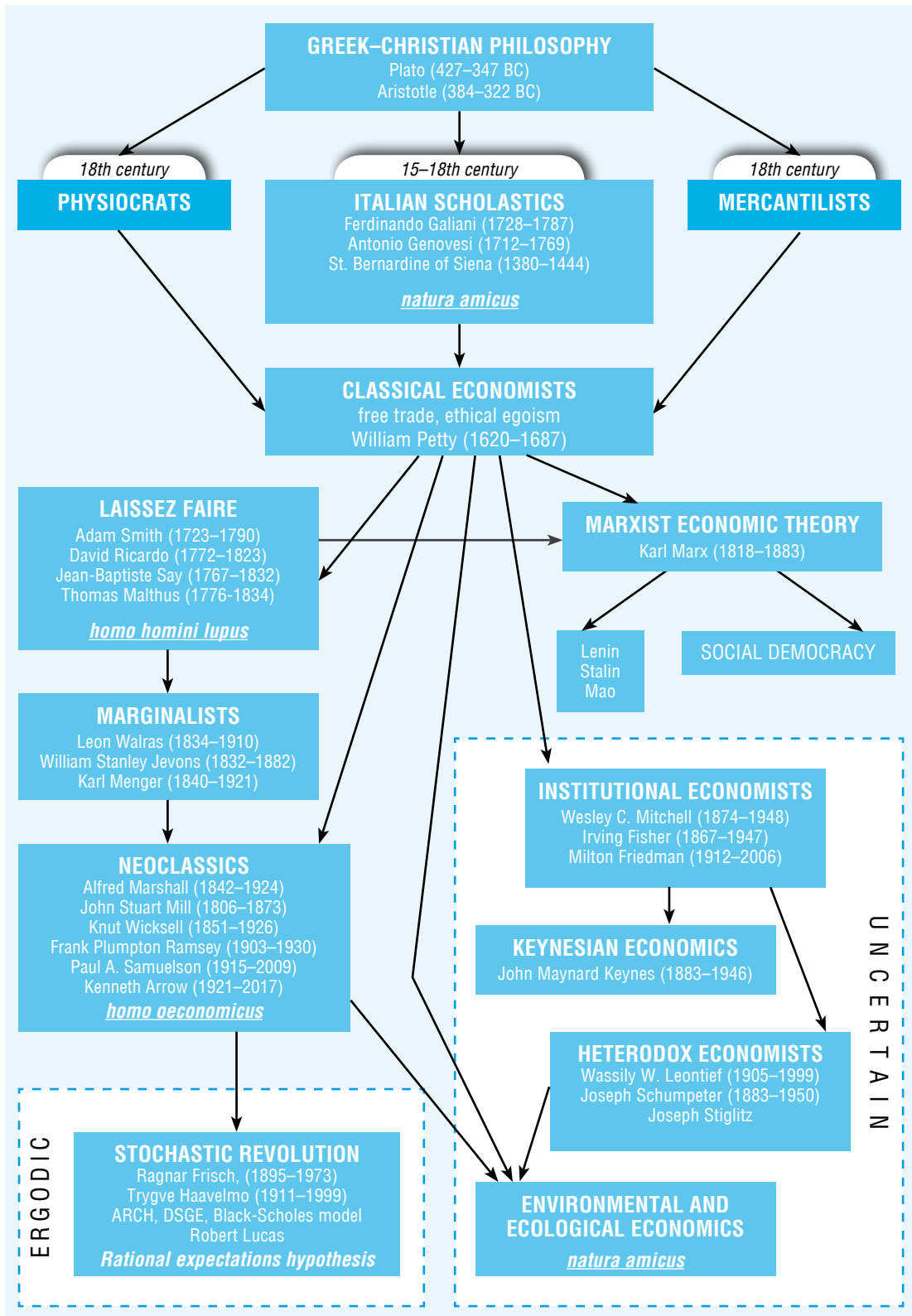
Naturally, one must have strong reservations over accepting Samuel Bjork's calculations and the ranking of Nobel Prize laureates in economics at face value. Citation counts are largely dependent on the scientific marketing of Nobel Prize laureates, and the road show of their papers. The greatest problem was posed by the JSTOR online database, which in the period considered for the calculations virtually excluded publications in languages other than English. At the same time, unlike the rest of the databases, JSTOR went back as far as 19th-century periodicals. This enabled Bjork to compare the citation record of Milton Friedman, with the highest Arrow index, to those of past giants such as Adam Smith, Karl Marx, Alfred Marshall and John M. Keynes for the period 1930–2005. Except for a brief period in the 1970s, the list was topped by classical economists, by Adam Smith in most years of the review period, and by Karl Marx from the mid-1970s to 1980. From 1980 onward, Adam Smith scored a much higher cumulative Arrow index than any Nobel Prize laureate in economics. From the late 1960s to the mid-1970s, Friedman overtook the giants of the past based on his Arrow index. However, Smith soon took the lead from Friedman, even ahead of Marx. In turn, Friedman's Arrow index subsequently remained above that of both Keynes and Marshall for the rest of the period, and Keynes overtook Marshall from 1950 onward, both having relatively stable Arrow indices.

Institutional economists are mostly ranked in the top half of the chart for the 57 Nobel Prize laureates in economics, which shows that economists had primarily been interested in and cited papers that analyse the prosperity and well-being of mankind. During the evolution of economics under real and feasible conditions, the institutional stream may be strengthened further by new theoretical and empirical answers to the challenges concerning the growth and development of the Asian region, particularly that of China³⁹ and India.

The theory proposed by the institutional economist Keynes (1936) identified the accumulation of wealth as the source of economic and social instability. *Piketty* (2014) goes further by addressing wealth inequality, which he explains, *ceteris paribus*, by the difference between the return on capital (r) and the growth rate of the economy (g), having found that $r > g$ based on a database of 20 developed countries for the past three centuries. This finding is often called into question in the literature, e.g. *Acemoglu and Robinson* (2015) contest the disregard for the endogenous evolution of economic and political institutions in his capital assessment. Both their regression calculations for South Africa and Swe-

den, and the Gini indices failed to confirm Thomas Piketty's findings, and calculations using panel VaR models led *Góes* (2016, p. 4) to assert that the "*potential causes of increasing inequality [...] are not related to $r-g$.*" While we have no reason to challenge the calculations of either author,⁴⁰ in view of the statistical data the presence of an enormous wealth inequality is apparent even without calculations. To reduce the inequality, Piketty proposes the introduction of a progressive wealth tax, which, however, will not provide a radical solution⁴¹ to the problem. In my view, the only effective solution possible, in both research on theoretical economics and socio-economic practice, is the reintegration of the economy and ethics,⁴² which were separated nearly 250 years ago by classical economists, most prominently by Adam Smith. Following the *laissez faire* principle, neoclassical economists clearly neglect ethics in their research, the impact of which is felt both in social and economic life. Ethics must also include a distribution of income that reflects recent changes in the structure of property rights. However, this discussion goes beyond the scope of this paper, and needs to be explained in another study.

ANNEX



NOTES

- ¹ Its focus was on classical Greek-Christian ethics, which was propagated by the civic humanist teachings of Neapolitan and Milanese schools in the 15th to 18th centuries [cf. Zamagni–Bruni (2017)]. “... [E]conomics was primarily an Italian science until the last quarter of the eighteenth century” (Schumpeter, 1955, p. 162). Due to the dominance of 18th-century England, these schools lost their influence on the global development of economics; however, classical economics adopted many perceptions of Italian scholastics, for instance, that the value of a good is determined by its utility (Saint Bernardino of Siena), and its price by the labour required to produce it.
- ² *Natura amicus* was replaced by *homo homini lupus*.
- ³ See Rand (1964).
- ⁴ As if time has stopped, the EU continues to be dominated by the same view to this day.
- ⁵ Smith (1776) adopted the metaphor “invisible hand” of the market from Mandeville’s book (1732), although he only made a single reference to it, presumably because Mandeville’s satire was strongly opposed to the principle of *laissez faire*. This single example aptly demonstrates that false legends also emerge in science.
- ⁶ It was William Petty (1620–1687) who first attempted to define wages and surplus value. In his argument, surplus value is composed of the rent of land and the rent of money (interest), which, combined with wages, forms the natural basis of price. He argued that the rate of interest depended on the demand for money and the money supply. He referred to the price of land as capitalised rent. He introduced political arithmetic as a new line of research. He had been convinced by *Francis Bacon* and *Thomas Hobbes* that mathematics and reason should provide the foundation for all rational sciences. To this day, these two disciplines are required for understanding and researching both neoclassical and institutional economics.
- ⁷ Somewhat before Say, the Italian Abbé Ferdinando Galiani (1728–1787) considered utility and scarcity to be the determinants of price. He was a contemporary of the Italian economist Antonio Genovesi (1712–1769), who, contrary to Smith, construed political economics in conjunction with ethics. Cf. Dolan (1976).
- ⁸ An adopted revolutionary name, attributed by some to the name *Lena*, and by others to the name of a Siberian river.
- ⁹ Marx’s *Capital* was progressive when it was published; however, today it is merely a fine memorial on Marx’s grave. Economics is a historical science; over time, the economy and society reach higher and higher levels of development; therefore, it is unreasonable to compare Marxism to the economic and social theories of later ages. This is precisely what gives economics its beauty in contrast with other disciplines.
- ¹⁰ Naturally, the static models of neoclassical economics are neutral to ergodicity.
- ¹¹ See Móczár (2008a) for details.
- ¹² Their assumptions were provided by the unrealistic assumptions of classical economics. For instance, the classical economist John Stuart Mill (1844) was convinced that it was necessary and desirable for every economy to reach a constant population and capital stock, i.e. a stationary state of the economy. See Móczár (2017), footnote 7 for additional unrealistic assumptions, and Móczár (2008a) for neo-positivist formalisations.

- ¹³ See later the impact and failure of Lucas's theory of rational expectations, or the fiasco of the Black–Scholes option pricing model.
- ¹⁴ See Móczár (2008a).
- ¹⁵ Marshall (1890).
- ¹⁶ See Móczár (2008a), p. 63.
- ¹⁷ Notably, Cournot taught political economics and mathematics to Auguste Walras, Leon Walras's father. Thus Cournot's equilibrium theory was a source of inspiration for Walras and his equilibrium theory.
- ¹⁸ Marshall's vision on the equilibrium time structure of supply and demand, i.e. temporary, intermediate and long-run equilibrium was introduced by John R. Hicks into his general equilibrium theory in his book *Value and Capital* (1939), together with the dynamic economics of the Swedish school founded by Wicksell. A number of mathematical techniques have been developed to analyse the stability of the equilibrium (see Móczár 2008/a, Allais 1997, Yasui 1950), which are elegant mind-training metaphysical propositions stated under unrealistic assumptions (that is to say, I hold them in a greater esteem than Keynes's "mathematical concoction"), but are completely useless in terms of economic policy and economic governance, i.e. for the accomplishment of the mission of economics.
- ¹⁹ Note that as the *Inada assumptions* had not been incorporated into *Solow's* (1956) assumptions, his model did not always provide non-trivial equilibrium, cf. *Inada* (1963).
- ²⁰ See Punzo (1991).
- ²¹ The Bourbakian school of mathematics emerged in France in the mid-1930s, and after World War II it quickly took root in neoclassical mathematical economics. It is no exaggeration to say that Bourbakism became the flag-bearer of the movement that advocated the supremacy of clarity over the applied, of the substantial over the frivolous, and of the fundamental over what one Bourbakist mathematician dismissed as "axiomatic trash". See Móczár (2008a) for more details.
- ²² For a critical analysis of the model, see Móczár (2017b). The validation of the model's scientific credibility by Düppe–Weintraub (2014) takes no mention of a number of relevant aspects, such as the debate between Hahn (1973) and Kornai (1971), whose works are not even cited by the authors.
- ²³ This citation from Arrow (1992) indicates that he did not follow the principle of ergodicity: "*In some ideal sense, life philosophies, like economies, may be refined by successive adjustments through reflection, experience, and intellectual interaction with the past and the present until they come into an equilibrium independent of initial conditions. In fact, neither is ever independent of history.*"
- ²⁴ For the establishment of the Cowles Commission and the first 20 twenty years of its activities, see *Christ* (1954), and for later years, Móczár (2008a).
- ²⁵ A stochastic process is the combination of random variables $(X_t, t \in T) = [X_t(\omega), t \in T, \omega \in \Omega]$ defined on a sample space Ω , where sample space Ω is the set of the possible outputs of a random phenomenon, and the aggregate of its observable events is described by a σ algebra. If T designates an interval, it is referred to as a continuous-time stochastic process, whereas if T is a finite or a countable infinite set, it is referred to as a discrete-time stochastic process.
- ²⁶ The model is a partial differential equation relying on the ergodic hypothesis, the practical application of which in the operation of the LTCM hedge

fund failed, eventually leading to the failure of the fund in 1998. For details, see Dunbar (2000).

i.e. by comparing their citation counts to that of Arrow's benchmark.

²⁷ See Lucas (1973).

²⁸ This proves that the rational expectations hypothesis can only be applied to ergodic (stable and stationary stochastic) processes. However, there is no such economy in the real world.

²⁹ See Hoover and Young (2013).

³⁰ Cf. Blinder (1999).

³¹ Friedman (1970, p. 207).

³² See Piketty (2014).

³³ This paragraph discusses the movement of the product market and the money market by taking into account expectations, which was erroneously modelled by Hicks (1937) in his IS-LM system without the Keynesian expectations.

³⁴ Cf. Skidelsky's (2009) interpretation, which simplifies Keynes's explanation, but in essence is acceptable nevertheless.

³⁵ Note that Keynes was an excellent speculator on the London Stock Exchange.

³⁶ For a description on the ideological and economic circumstances of the establishment of the Nobel Prize in economics and an assessment of individual Nobel laureates, see Offer-Söderberg (2016). The assessment was carried out using the appropriately adjusted Bass model (1969) based on the JSTOR database by calculating the so-called Arrow index for each of the 57 Nobel Prize laureates in economics between 1969 and 2005. The 57 laureates were ranked by their Arrow indices,

³⁷ Offer-Söderberg (2016, p. 113) distinguish between liberal and conservative Nobel Prize laureates in an American classification (market equilibrium is rejected by the former and accepted by the latter), also in roughly equal numbers. Meaningfully, Nobel Prize laureate econometrists and game theorists are also treated separately.

³⁸ During the first 25 years of the Nobel Prize in economics, the selection of laureates was dominated by Assar Lindbeck as a member of the Economics Prize Selection Committee, and also as its chair (its Swedish kingmaker, as it were) for 15 years from 1980 to 1994. In his capacity as director of the Institute of International Economics at Stockholm University, he was at the peak of the Swedish economics profession, in a position that allowed him to make or break academic careers. One member of the Nobel Committee referred to him as "*kind of a mafia leader, a fixer*", who did not even hold membership in the Academy. His chief supporter was Swedish social-democrat Prime Minister Olof Palme (cf. Offer-Söderberg, 2016, p. 179).

³⁹ See Xu (2011).

⁴⁰ Although it should be noted that calculations in financial econometrics are mere estimates subject to unrealistic assumptions and strong distortions, especially where proxy variables are used.

⁴¹ "*However, the best available data show that, if one is looking to potential solutions to increasing income inequality, one should not focus on $r - g$, but elsewhere*" (Góes 2016, p.24).

⁴² Weber (1982), Rand (1964).

REFERENCES

- ACEMOGLU, D. – ROBINSON, J. A. (2015): The Rise and Decline of General Laws of Capitalism. *Journal of Economic Perspectives*, Vol. 29. No. 1, pp. 3–28
- ALLAIS, M. (1997): An Outline of My Main Contributions to Economic Science. *American Economic Review*, Vol. 87, No. 6, pp. 3–12
- ARROW, J. K. (1992): I Know a Hawk from a Handsaw. In: *Eminent Economists: Their Life and Philosophies* (ed.: Michael Szenberg), pp. 42–50. CUP, Cambridge
- ARROW, J. K. – DEBREU, G. (1954): Existence of an Equilibrium for a Competitive Economy. *Econometrica*, Vol. 22, No. 3, pp. 265–290
- BASS, M. F. (1969): A new product growth for model consumer durables. *Management Science*, 15 (5), pp. 215–227
- BLACK, F. – SCHOLES, M. (1973): The Pricing Options and Corporate Liabilities. *Journal of Political Economy*, May–June, pp. 637–654
- BLINDER, A. S. (1999): Economics becomes a science – or does it? In: *Useful Knowledge: The American Philosophical Society Millennium Program* (ed.: A. Bearn), pp. 141–154. Philadelphia: American Philosophical Society
- CASS, D. (1965): Optimum Growth in an Aggregate Model of Capital Accumulation. *Review of Economic Studies*, July, pp. 233–240
- CHRIST, C. (1954): A Twenty Year Research Report, 1932–1952. Mimeo, Cowles Commission, Chicago
- COURNOT, A. A. (1838/1963): *Researches into Mathematical Principles of the Theory of Wealth*. Trans. by N. Bacon, Homewood, Irwin, IL
- DOLAN, E. G. (ed.) (1976): *The Foundation of Modern Austrian Economics*. Sheed & Ward, Inc., Kansas City
- DUNBAR, N. (2000): *Inventing Money: The Long-Term Capital Management and The Legends Behind It*. John Wiley & Sons, London
- DÜPPE, T. – WEINTRAUB, E. R. (2014): *Finding Equilibrium: Arrow, Debreu, McKenzie and the problem of scientific credit*. Princeton University Press, Princeton
- FRIEDMAN, M. (1986): *Infláció, munkanélküliség, monetarizmus (Inflation, Unemployment and Monetarism)*. Közgazdasági és Jogi Könyvkiadó, Budapest
- FRIEDMAN, M. (1968): The Role of Monetary Policy. *American Economic Review*, 58(1), pp. 1–17
- GALBRAITH, J. K. (1969): *The New Industrial State*. Penguin, Harmondsworth
- GÓES, C. (2016): Testing Piketty’s Hypothesis on the Drivers of Income Inequality: Evidence from Panel VARs with Heterogeneous Dynamics. *IMF Working Paper*, WP/16/160
- HAHN, F. (1973): The Winter of our Discontent. *Economica*, August, pp. 322–330
- HAMILTON, W. H. (1919): The Institutional Approach to Economic Theory. *American Economic Review*, 9, Supplement, pp. 309–318
- HICKS, J. R. (1939): *Value and Capital*. Oxford University Press, Oxford
- HICKS, R. J. (1937): Mr. Keynes and the Classics: A Suggested Interpretation. *Econometrica*, Vol. 5. No. 2, pp. 147–159

- HODGSON, M. G. (2000): What is the Essence of Institutional Economics? *Journal of Economic Issues*, Vol. XXXIV. No. 2, pp. 317–329
- HOOVER, D. K. – YOUNG, W. (2013): Rational Expectations: Retrospect and Prospect. A Panel Discussion with Michael Lowell, Robert Lucas, Dale Mortensen, Robert Shiller, and Neil Wallace. *Macroeconomic Dynamics*, Vol. 17, Issue 5, pp. 1169–1192
- INADA, K. (1963): On a Two-Sector Model of Economic Growth: A Comment. *Review of Economic Studies*, Vol. 30, Issue 2, pp. 119–127
- JEVONS, W. S. (1874/1924): *The Theory of Political Economy*. MacMillan, London
- KEYNES, J. M. (1919): *The Economic Consequences of the Peace*. Harcourt, Brace and Howe, New York
- KEYNES, J. M. (1926): *The End of Laissez-Faire*, Hogarth Press, London
- KEYNES, J. M. (1936): *The General Theory of Employment, Interest, and Money*. A Harbinger Book, Harcourt, Brace World, Inc. New York, Chicago
- KORNAL, J. (1971): *Anti-equilibrium: On Economic Systems Theory and the Tasks of Research*. North-Holland Publishing Co., Amsterdam
- LUCAS, E. R. (1973): Some International Evidence on Output-Inflation Trade-offs. *American Economic Review*, Vol. LXIII, Issue 3, pp. 326–334
- LUCAS, R. – SARGENT, T. J. (eds.) (1981): *Rational Expectations and Econometric Practice*. University of Minnesota Press, Minnesota
- MANDEVILLE, B. (1732): *The Fable of the Bees or Private Vices, Public Benefits*. Vol.1–2, The Clarendon Press, Oxford
- MARSHALL, A. (1890): *Principles of Economics*. MacMillan, London
- MARX, K.: *Capital: A Critique of Political Economy*. VOLUME I (1867): *The Process of Capitalist Production*. Original English trans. by Moore and Aveling. Revised and amplified according to the 4th German ed. by E. Untermann. Chicago, Charles H. Kerr Co., 1906
- VOL. II, *The Process of Circulation of Capital* (1885), trans. by Untermann, Chicago, Charles H. Kerr Co. 1909
- VOLUME III (1894): *The Process of Capitalist Production as a Whole*. Trans. by Untermann. Chicago, Charles H. Kerr Co. 1909
- MILL, J. S. (1844): *Essays on Some Unsettled Questions of Political Economy*. John W. Parker, London
- MIROWSKI, PH. (1984): Physics and the ‘marginalist revolution’. *Cambridge Journal of Economics*, Vol. 8, Issue 4, pp. 361–379
- MÓCZÁR, J. (2008a): *Fejezetek a modern közgazdaság-tudományból, Sztochasztikus és dinamikus nemegyensúlyi elméletek, természettudományos közelítések (Chapters from modern economic theory, Stochastic and dynamic nonequilibrium theories, scientific approaches)*. Akadémiai Kiadó, Budapest
- MÓCZÁR, J. (2008b): Közgazdaságtan vagy közgazdaság-tudomány? I. rész. A 20. század legfontosabb eredményei (Economics: Study or Science? Part I: Key Achievements in the 20th Century). *Competitio*, 7(2). pp. 5–34
- MÓCZÁR, J. (2009): Közgazdaságtan vagy közgazdaság-tudomány? II. rész. A 20. század legfontosabb eredményei (Economics: Study or Science? Part II: Key Achievements in the 20th Century). *Competitio*, 8(1). pp. 76–97
- MÓCZÁR, J. (2015): Kornai’s DRSE Theory versus General Equilibrium Theory. *Public Finance Quarterly*

- terly, Vol. 60(2), pp. 194–211, State Audit Office of Hungary, Budapest
- MÓCZÁR, J. (2017a): Ergodic versus uncertain financial processes, Part I: Ergodic hypothesis and uncertainty in financial theory. *Public Finance Quarterly*, Vol. 62(3), pp. 1–27, State Audit Office of Hungary, Budapest
- MÓCZÁR, J. (2017b): Arrow-Debreu Model versus Kornai-critique. *Athens Journal of Business & Economics*, Vol. 3. No. 2, pp. 143–169
- MÓCZÁR, J. – TSUKUI, J. (1992): Balanced and Unbalanced Growth Paths in a Decomposable Economy: Contributions to the Theory of the Multiple Turnpikes. *Economic Systems Research*, Vol. 3, No. 3, pp. 221–222
- VON NEUMANN, J. (1945): A Model of General Economic Equilibrium. *Review of Economic Studies*, Vol. 13, No. 1, pp. 1–9
- OFFER, A. – SÖDERBERG, G. (2016): *The Nobel Factor. The Prize in Economics, Social Democracy, and the Market Turn*. Princeton University Press, Princeton and Oxford
- PHELPS, S. E. (1961): The Golden Rule of Accumulation. A Fable for Growthmen. *American Economic Review*, Vol. 51, No. 4, pp. 638–643
- PIKETTY, T. (2014): *Capital in the Twenty-First Century*. Harvard University Press, Cambridge, MA
- PUNZO, L. (1991): The School of Mathematical Formalism and the Viennese Circle of Mathematical Economists. *Journal of the History of Economic Thought*, Vol. 13, Issue 1, pp. 1–18
- RAMSEY, P. F. (1928): A mathematical theory of saving. *Economic Journal*, Vol. 38, No. 152, pp. 543–559
- RAND, A. (1964): *The Virtue of Selfishness*. Penguin Books Ltd., New York
- SAMUELSON, P. A. (1958): An Exact Consumption-Loan Model of Interest with or without the Social Contrivance of Money. *The Journal of Political Economy*, Vol. 66, No. 6, pp. 1467–1482
- SAMUELSON, P. A. – Nordhaus, W. D. (1995): *Economics*. McGraw-Hill, New York
- SAY, J. (1803): *Traite d'economie politique*. Deterville. Paris
- SCHUMPETER, J. A. (1955): *History of Economic Analysis*. George Allen & Unwin Ltd. London
- SKIDELSKY, R. (2009): *Keynes: The Return of the Master*. Public Affairs, New York
- SMITH, A. (1759/1792/1976): *The Theory of Moral Sentiments*. Clarendon Press, Oxford
- SMITH, A. (1776): *An Inquiry into the Nature and Causes of the Wealth of Nations*. W. Strahan and T. Cadell, London
- SOLOW, M. R. (1956): A Contribution to the Theory of Economic Growth. *Quarterly Journal of Economics*, Vol. 70, No. 1, pp. 65–94
- The Collected Writings of John Maynard Keynes* (1971–1989). Macmillan/Cambridge University Press for the Royal Economic Society
- TSUKUI, J. – MURAKAMI, Y. (1979): *Turnpike optimality in input-output systems. Theory and application for planning*. North-Holland, Amsterdam
- TSURU, SH. (1993): *Institutional Economics Revisited*. Cambridge University Press, Cambridge
- WEBER, M. (1982): *The Protestant Ethic and the*

Spirit of Capitalism (A protestáns etika és a kapitalizmus szelleme). Gondolat Kiadó, Budapest

XU, CH. (2011): The Fundamental Institution of China's Reforms and Development. *Journal of Economic Literature*, Vol. 49, No. 4, pp. 1076–1151

YASUI, T. (1950): Antei no ippanriron. *Rironkeizaigaku*, Vol. 1, No. 1, pp. 13–32

ZAMAGNI, S. – BRUNI, L. (2017): *Civil Economy: Another Idea of the Market*. Columbia University Press, New York