Springer Studies in Alternative Economics

Andri Werner Stahel

Regenerative Oikonomics

A New Perspective on the Economic Process

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What Went Wrong with Modern Economic Science?

Chapter 1
Introduction: Encounter of the Fifth Kind with an Alien Science

By finishing school, having to decide my future career, I was torn between wildly different options. It ranged from astrophysics, being as I was fascinated staring at the night sky and just wondering about the sheer magnitude, immensity and power of cosmic events which brought our world and us to being, to designing homes as an architect or exploring the inner complexities of our consciousness, feelings and thoughts as a psychologist. In short, as it happens to many who do not feel a clear vocation, I was short of answers once confronted with the first important question I had to answer by myself. Or, maybe, I had too many.

At that time, one of my best friends and classmates going through the same process came up with economics. It immediately struck a chord in me: on the one hand, not as abstract and removed from our human world and reality as I was afraid astrophysics could be. On the other, economics was not as close to our individual human experience and emotions as psychology, which I did not feel comfortable with. At the same time, it seemed to leave the doors open to different future paths, from more academic and reflective, which were my stronger inclinations, to more applied and 'useful' ones. Indeed, economics seemed to me to keep open different career options and possibilities in the future, thus allowing me to postpone all these decisions. In any case, it gave my youthful idealistic dreams the needed fuel: having big, sometimes megalomaniac dreams of changing the world, it just seemed fitting to me to spend some time studying and trying to understand the economy once, as the saying goes, 'economy rules the world'. Thus, my youthful logic went, by understanding how the economy works, I would know how to change the world better.

But big was my deception once entering the actual study of economics. Little of what we studied seemed to relate to the real world and give me a better clue on how to fix it eventually. Moreover, by considering the economic process in purely mathematical and reductionist ways, I was being led to believe that instead of looking and studying the world in practical terms, carefully observing and understanding it as it unfolds before our eyes, what we had to do was to look at some highly simplified and idealised models of reality instead. Indeed, economics was portrayed the same way I had learned about Newtonian physics back in school. It

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consisted of a series of simplified models of reality whose maths and equations we were asked to solve. Thereby, as for physics, a series of abstract models based on a series of assumptions were presented to us. Notwithstanding, unless for physics dealing with a much simpler reality and much fewer parameters, the models we studied were utterly unrealistic and unobserved in the real world. But we had not to bother about that. We just had to solve the equations or, more quickly, do some graphic representations and look at how the different curves are shaped and intersect.

Instead of trying to understand our world as a historical, context-dependent and ever-changing reality, fruit of past choices, power relations and struggles, we had to look at it just as physicists do: from the outside, objectively, only in abstract and quantitative terms and through our exercises in number crunching, reveal its supposedly underlying universal, immutable laws. Economics was presented to me as an exact science created at the Newtonian mechanics' image and resemblance. Thus, after having avoided astrophysics, I ended up studying a world as removed from my daily experience or even more because of being inexistent. The reality of abstract models applied to an 'as if' world.

But there were still some exceptions. Having studied in Brazil in the 1980s, we had classes in economic history, history of economic thought, classic political economy's value theories and Marxists economics and some introductory courses to sociology. But these short incursions into some empirical, historical facts-based descriptions and analysis were disconnected from that which was presented to us as the central core of what sound economics as a science was supposed to be: microeconomic and macroeconomic theory, trade theory, econometrics and plenty classes in mathematics and statistics. Economics was presented to us not as social and historical science but as a mathematical, exact science. Nor was any actual historical fact represented in the models.

I still remember that having studied at the University of São Paulo (USP) campus, I could choose two optional courses and the corresponding credits elsewhere. It was an opportunity which I readily took, walking to the neighbouring faculty of philosophy, literature and human sciences to take some courses in contemporary history. Thus, I hoped to compensate for the total lack of it in our economics course, as if the economic process was not a historical process too. To me, it was a life-changing experience. There, I could see how actual history was approached in observational and empirical ways, not just by creating an abstract 'as if' model of reality to represent it in mathematical and numerical terms. Nor would historians try to explain history through formula. But, I asked myself, 'wasn't the economic process a historically, context-dependent, complex process too?' Why could we, in economics, simply ignore cultural, political and environmental factors and portray the economic activity as happening in an ahistorical, unchanging world governed by universal laws instead?

While history students had to dwell in the study of real-world events that happened in the past, trying to understand how real people took their decisions and how these decisions affected the unwinding of history, we would just deal with imaginary actors, behaving in assumed mechanical ways, thus affecting developments we could precisely predict. It struck me how different their approach to history

was to mine and how contentious and vivid their debates were. Some were arguing one way; others another. Some were deepening the argument by bringing other dimensions and elements into it; others referring to empirical facts to sustain their point. But all looked at actual historical facts and realities to support their arguments to understand history's underlying forces and movements. No one would argue or make a point by quoting the outcome of abstract mathematical models of reality. I always thought (and still believe) economics to be a social, historical science. It has to do with how we humans, in historically and culturally specific changing ways, aim to satisfy our fundamental needs. It deals with how we (re)produce and distribute wealth by transforming the resources we find in our environment through labour, according to different social structures, cultural values and technological means. Why were we using such a different method to approach this reality, unlike all other social sciences? At that time, I could not yet find the answers, busy as I was to simply memorise and learn to use the method I was being taught to get approved and receive my diploma.

In parallel, hoping to enlarge my perspectives, I decided to engage in a very broad-minded graduate course in public administration at the Getúlio Vargas Foundation (FGV in its Brazilian initials). There, I had the privilege of taking classes in psychology, sociology and communication theory and looking at some case studies. Being designed to train future executives of actual public and private companies, public administrators and servants, we had to learn some fundamental skills and understand real-world realities to be effective. Knowing how to solve some equations in an abstract model would certainly not do. I still remember, many years later, when I started to teach as an assistant teacher at the Autonomous University of Barcelona (UAB in its Catalan Initials), meeting there another teacher like me. She was in her 30s, having to revalidate her place every couple of years as I had to. Not having thought about it myself, I was surprised to hear how scared she was of losing her job as a teacher in economics, afraid of not having qualifications and skills to work in the real world outside the academy. First, it struck me that someone could think like that. But giving it some thought, I understood her point. Indeed, very little of what we learn and teach as economists prepare us to live and work in the real world—to engage with concrete markets, real human beings and social relations. Looking back now, I can see that very little of what I found in the economics textbooks helped me to understand the world better and do my best to better it as I had hoped for.

Instead, I had to look elsewhere. It was mostly all that I learned besides and beyond the official curriculum in economics, which helped me keep a broader perspective on the economic process, despite the narrow funnel professional economics was squeezing me through. Thus, I gradually observed how my academic path was diverging from economists' standard, expected way. The more we advanced in our graduate course, the more we were brainwashed to lock at the economic process in a purely abstract, ahistorical and theoretical way. At the same time, the more I came to doubt that this was the right way to approach the economic process and started to look elsewhere. The economic process is a historical, social process that is not, by any means, governed by purely mechanical, cause and effect,

universal and immutable natural laws. It is not—and it has never been—a process akin to simple natural phenomena like the one studied by Newtonian physics and other natural sciences in which recurring relations and dynamics can be observed and repeated in controlled laboratory conditions if needed, removing other factors from altering the outcome. History does not repeat itself, I once was told. Nor can we create frictionless environments and controlled laboratory conditions to observe economic processes and validate or refute our models' predictions.

Notwithstanding, I was told that we economists had to remain 'objective scientists' and not be swept by subjective perceptions as humanists and social scientists were prone to be. We had to do just like 'real', 'objective' scientists did in the natural and exact sciences. Just as physicists studying distant stars or engineers studying a mechanical machine's functioning are supposed to be. We had to look only at the quantitative and measurable aspect of a supposedly 'objective reality', refraining from and disregarding all qualitative assertions and assessments about the real world. Follow the mathematical method and let the mathematics do the talking. But the clear difference from basing our knowledge of the complex historical economic reality on idealised models, from the practice of an engineer or physicist reducing his gaze to simple phenomena, was never seriously considered. At a given point, there are always straightforward empirical tests machines or bridges have to endure once built, thus asking them not to leave out of their models and studies relevant real-world aspects. But not so for economics: our models did not bother whether they are empirically relevant and close to actual reality. Nor have they to endure empirical tests.

Although looking at abstract models and letting themselves be carried by the mathematical conclusions of these models, physics still has to confront their clear-cut predictions with empirical observations. Carefully designed experiments and even human expeditions to distant places to observe the predicted curvature of space by following a star's apparent position at sun eclipses have been done to test Einstein's conclusions and predictions. Over US$7.5 billion have been spent to build the Large Hadron Collider in Geneva to try and advance in the highly speculative, mathematical predictions of modern quantum physics. Although idealising an abstract model on how chemical bonds between different elements happen, chemists may still observe actual chemical reactions in a laboratory and see if the model's conclusions are consistent with them.

Nothing alike happens in the social and historical sciences. Nor in economics. A historian trying to understand the fall of the Roman Empire or, indeed, an economist trying to explain why the Industrial Revolution happened in Britain and not in China, for instance, cannot recur to repeating examples always showing the same pattern and result. Nor can they realise a series of experiments in the laboratory, trying to verify their models' predictions. Certain aspects and underlying forces can be found and described in different historical realities. But no clear-cut prediction can be tested once each historical context has its particular characteristics, colours and flavours, defying any attempt to explain it through some simple recurring cause and effect relations. The fact that we were dealing with a messy and complex reality in which all kinds of continuously changing factors were interfering and affecting

the outcomes was presented as unfortunate but not as something that should deter us from basing ourselves on theoretical models.

Economics was given to us as consisting of 'a neutral *toolbox*' to be used by others. It was called 'positive economics' to separate it from the 'normative economics' and those who included value judgments and questionings in their analysis. In any case, 'positive economics' sounded much more correct than the normative, value-tainted sort of science we were told other social scientists were doing. Indeed, we were repeatedly being warned that all these left-winged Marxists and those questioning the existing political and ideological status quo were not doing good science but defending an ideology instead, as those like Hayek or Popper argued. It was argued that Marxism was not open to falsificationism. But, somehow, the same argument was not applied to neoclassic economics and standard trade theories, which happened to 'prove' that free markets would lead to 'maximum efficiency' and 'Pareto optimality'.

The more I advanced in my studies, the more considerations about the economic process's social, historical, cultural and political dimensions were to become absent from my curriculum, ending up being ignored as 'externalities' altogether. They were all seen as aspects that do not concern us as professional economists. Thus, not just in method but in its content, I was told that what I always believed to be a social and historically changing process, the economic process, had to be seen instead as a natural phenomenon, governed by universal mathematical laws. Paradoxically, the natural phenomenon which undoubtedly was of central importance to the economic process, namely, the working of ecosystems and the biosphere as a whole through which our lives and our economy unfolds, was utterly absent from my studies back in the 1980s and early 1990s. Although Nicholas Georgescu-Roegen, a brilliant and well-known economist, had already in the early 1970s pointed to the fact that biology and ecology, not Newtonian physics, should be the 'true Mecca' for the economists and that, in physics, thermodynamics and the entropy law, 'the most economic of all physical laws', had to guide our studies, all my official studies in economics ignored ecology and any attempt to come at terms with the physical, real-world nature of the economic process. It was—and still is—an alien science, dealing with abstract worlds instead of the real world I was hoping to understand better.

Chapter 2
Is Economics a Science?

This is the title of a paper I recently published, aiming to take this question seriously (Stahel, 2020b). I did so wondering how bold an argument my negative answer to this question was. After all, economics, in the way it is practised and taught, has been hegemonic in the academy for over a century. Tens or hundreds of thousands of people have and still devote their lives to studying economics, assuming it to be a science. Thousands of papers are published in prestigious *scientific journals*, and some professionals are called to share their scientific expertise and counsel. Nobel Prizes and other scientific distinctions are awarded, thus reaffirming the scientific status of what I have been trained to be. Could it be that it is not a science after all? To be sure, many serious critiques have been made to economics over the years. But to question its scientific status in bulk is another matter. After all, the Nobel Prize in Economics, which has been added to the initial ones created by Alfred Nobel, was assumed to recognise scientific contributions, not fiction.

At this time, I had already realised that *oiko-nomos* in Greek means to 'manage our home'. Having affiliated me to *ecological economics* as my specialisation in the field, I knew too that our home had to be understood not just as our domestic space but the larger environment we live in, our Earth. Hence the root for the word 'ecology' as well: *oiko-logos*.[1] But, particularly after reading Aristotle's ideas about the oikonomy in his *Politics*, I gradually realised that what the Greeks understood as being the *oikonomy* has little to do with what we nowadays believe it to be. Indeed, we nowadays consider being the 'economy' that which the Greeks called *chrematistics* or commerce. To them, 'the art of acquisition', when correctly done, represents just a part of the larger *oikonomy*. Chrematistics has to do with selling and buying in the markets only. Much broader in its scope, the *oikonomy* deals with how we manage our shared home, relate to each other and Nature, aiming

[1] The etymology of the word is now clearly established, reaching back to the Greek word οἰκονόμος/oikonoms (i.e. 'household management', a composite word derived from οἶκος/oikos ('house') and νέμω/nemein ('to manage; distribute') by way of οἰκονομία/oikonomia.

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to produce, distribute and consume wealth to sustain our lives and hopefully a *good life*, be it through trade, be it otherwise. But more of that later.

In any case, the considerable difference between the Greeks and following their steps I came to believe constitutes the *oikonomy*, and the limited and reductionist perception of what the *economy* is all about in our modern world, made me recover the term *oikonomy* in a previous book I wrote where I aimed to ground this idea on a more academic-minded way (Stahel, 2020a). I felt the need to differentiate it from the more limited economy notion, which has become the norm and is a direct result of the reductionist perspective of our modern economics. When referring to the *oikonomy*, I'm not talking solely about chrematistics or commerce, as further shown later—a differentiation I keep and will be keeping along these lines.

But it is not just the scope of what is considered 'the economy', but, more importantly, the way it is approached by modern neoclassic economics that is at the heart of the problem. When Adam Smith wrote his *Inquiry into the Nature and Causes of the Wealth of Nations* and later in the nineteenth century when economics consolidated as a separate branch of science, natural sciences, in general, and Newton's mechanics, in particular, set the paradigm of science. Its method was seen as the example to be followed. So did the architects of modern economics, particularly in the second half of the nineteenth century when the neoclassic approach was consolidated to become not just hegemonic but, basically, the only way to approach the economic process in the academy, leaving the historical method and other alternative methods aside. Instead of looking to the oikonomy in holistic and living ways, as an ever historically changing creative process whereby new historical realities emerge, the economic process has been depicted in purely mathematical, abstract and reductionist ways. Economics was created at the image and resemblance of Newtonian physics. Without considering that Newton's method was devised to look at the laws governing the movement of passive bodies, of lifeless planets orbiting the sun or of perfectly elastic assumed billiard balls with different masses colliding at different speeds and angles. It was not meant to look at a complex, ever-changing political and historical process.

As for Newton's laws depicting inertial bodies' movement, the economic process laws were described as universal and unchanging. But, to do so, reality had to be significantly reduced to some relatively simple, linear causal relations between a few variables. Instead of a complex, irreversible historical process, the economy was—and still is—represented using straightforward functions and equations.

Like aspiring economists worldwide, my studies resembled a somehow more complicated version of those I had back in school when I was taught Newton's mechanics. In both cases, a simple idealised model consisting of some variables was presented, the functions relating all these variables among them in causal ways described, and I was asked to answer some hypothetical questions like 'if the government increases the money supply by 10%, what will the new equilibrium interest rate be?' Just as when, back in school, I was asked what would be the resulting speed and trajectory of two colliding billiard balls with given masses be, assuming them to be perfectly elastic and moving in a friction-free environment. Then I did the maths, hoped to get them right and looked at the correct answer at the

end of the book. Or I had to wait for my exam grades to know. Just how I learned to do back in school for physics. Thus, focusing on the method and procedures, it was easy to forget the real world we were supposed to be studying. As so many others did and still do, merely assuming that this is the way it is and not bothering too much about it. After all, we were doing good science, I was told. I always remember a joke we used to repeat when asked to present a small paper for some grades. We looked at each other's work, searching for numbers and formulas. Going over descriptive or narratively argued pages, we would shake our heads in dismissal, saying 'just words, no science, bad…'. But, as soon as numbers and equations were presented, we approvingly said 'now yes, here I see science'… Indeed, an ironic way to handle our frustration of doing something we felt was heading in the wrong direction. But we did it anyway until eventually believing it to be the only way for doing it.

But the implications of applying Newton's method to a complex, historically changing reality were never considered more in-depth. Nor was it explained why Newton's same simplifying assumptions ignoring air friction to look at the movement of falling bodies could be applied to ignore cultural, political, administrative, ecological and personal choice factors affecting the economic process. Indeed, to treat and study the oikonomic process in the same way Galileo and later Newton tried to investigate the laws governing the movement of inertial bodies, modern economists had found a clever way to stick to the mechanistic paradigm. They started to use and abuse the so-called ceteris paribus condition, a little Latin economist worldwide learn, meaning everything else remaining unchanged. By assuming these variables as unchanging, they do not affect the other endogenous variables of the model and can, thus, be ignored. Just as Newton assumed that there was no friction involving the inertial motion of the studied bodies or, in the case of colliding objects, considered perfect elasticity to ignore the losses to heat and other factors affecting the collision of objects in non-laboratory conditions. Thus, economists too resorted to an idealised, abstract, frictionless world in which clearly definable cause-effect dynamics govern everything—ignoring the phenomenon's complexity and all variables that simple linear functions cannot describe. But we never were asked, nor did we seriously asked ourselves, whether human behaviour and complex sociohistorical dynamics could be studied in the way Newton had studied the effects of gravity on falling apples or orbiting planets in empty space. It is easy to forget the difference in the behaviour of passive bodies studied by Newtonian physics and that of living beings and historically changing societies. Focusing on the method and believing it to be exact and scientific, we easily ignore that we cannot treat in the same way objects and living beings. The former does follow inertial movements, and their trajectories respond solely to external forces affecting them. But the latter continuously change their behaviour and course even in the absence of an external force affecting them due to their inner changes and metabolism. Notwithstanding, in economics, we simply managed to assume strictly linear and predictable behaviour.

As a teacher, in my classes, sometimes I would hold a pen over the floor and ask my students if they could calculate how long it would take for it to reach the floor if I let it fall. Applying Newton's equations or previous observations, a reasonably

precise guess could be obtained. But what if, as a teacher trying to make my point that human behaviour is non-linear, I decided to pick the falling pen with my other hand before reaching the ground? Indeed, including me in the picture meant that the time the pen would take to get to the ground could not be calculated in advance, ranging from less than a second when I did not catch it to never reaching the bottom when I did. In some cases, when I missed the catch, it eventually was projected and fell somewhere else after describing a further trajectory. Or it could be caught by a student before reaching the floor. Like other historical or living events, the result could be understood and explained retrospectively but not calculated in advance.

By arguing that economists were making a 'cut in time' and thus considering only the very short term in which there is no ecological, technological, political, institutional, cultural, indeed historical change, I was presented to models in which just a few called endogenous variables like prices, interest rate, output/quantity, income or other 'economic variables' were considered. All the others were simply ignored by assuming them as 'unchanging'—ceteris paribus. Thus, a causal relation between the models' variables can be established, unaffected by all the other 'exogenous variables' who, miraculously maybe, patiently remained unchanging in the meanwhile. Like in these movies where, suddenly, all other elements of the image stop and just the main character moves amid the frozen picture. Or, to come back to the example of the falling pen, assuming that we all—me included—would remain static observing the falling pen, thus not interfering in its trajectory. Just as politics, cultural values, individual and collective preferences, the environment, etc. are assumed to be static and unchanging, while the oikonomic process unfolds.

The sheer audacity of simply imagining an abstract, laboratory conditions world in which causal changes and relations were 'scientifically' stated while, to do so, we merely imagine all the rest of the picture remaining unmoving, never sounded as absurd to me as it does now while writing it down again. Legions of students and economists simply accept it as a valid methodological procedure and go on doing it. Some may hope to earn a Nobel Prize for it or at least the praise of their peers; others merely wish to be recognised as professional economists. But all undeterred by its logical and empirical absurdity: ceteris paribus simply does not happen to happen in the real world in which everything is in constant movement. Nor can we freeze all the rest and just keep alive and change some chosen elements or characters, except, of course, in fiction and movies. But that is precisely what we, as economists, are taught to do at the core of our 'scientific praxis'.

Some of us had some doubts about this practice. So did I. At times, when presented with the assumptions underlying some models and economic theories, some of us would eventually ask, 'but why are you assuming that?' 'How can you assume that there is no technological change?' 'Can we simply assume that there are no political and administrative factors affecting the market?' 'Nor consider that there are subjective, "irrational" factors affecting the consumer choices?' The answers given were invariably the same: the ceteris paribus assumption is a needed tool to represent the model in the first place. Without this assumption, it would not just be too messy but downright impossible to create mathematical models of reality. Indeed, how do you state qualitative change and the complex, multidimensional

oikonomic dynamics if not by enormously simplifying it? Thus, as the argument went, assuming all these variables as being external and unchanging was just the price we, as economists, had to pay to explain the oikonomic process just as elegantly and precisely as Newton had done for the movement of cosmic and earthly bodies. Ignoring that believing the moon is a passive body following an inertial motion in a frictionless environment is entirely different from assuming that markets exist in a frictionless world. We cannot believe that they are untouched by political, cultural and technological factors or that humans behave purely mechanical and rationally, provided with 'perfect information'. But this is what economists do and what I was told to do to remain 'scientific'.

This is what we got. As students, we were there to learn, not to question, what had been established as the proper methodology by legions of previous very bright minds and famous economists. Or maybe more importantly for us, we needed to get grades at the final exams to get our diploma and pursue our careers. Thus, we ended up no longer bothering to ask, focused as we were to assimilate the different models' mathematical logic and solve the equations. To become clever puzzle-solvers and accept that this is the way the science of economics works. Implicitly if not explicitly, assuming that the oikonomic process happens in an ecological, social, political, cultural and historical void.

Thus, given enough time, we ended up forgetting this crucial difference: Newton's law of movement applies to passive objects, not to living beings, as any observation of flying birds or walking ants shows. The assumption of inertial motion is a central aspect of Newton's mechanics. Objects follow inertial trajectories, only affected by external forces and the impacting force of other things. A fallen apple's course does not follow Newton's law once caught in his flight by a human hand before reaching the ground. Nor would the moon's movements and orbit be as predictable if he had a will of his own and a particular love for dancing to the music of the cosmic spheres in his way.

Applying the Newtonian methodology to human oikonomy posed a further challenge given that humans are moved by their will, passions, ideas, aims, values and potentially changing purposes. Thus, how to represent human behaviour in a predictable way as mechanics does for inert bodies? Here too, economists found a convenient and easy solution. Instead of painstakingly figuring out why humans behave the way they behave, like sociologists, psychologists, historians, political scientists or anthropologists do, economists just assumed the existence of a new specimen: *homo oeconomicus*, the 'cost minimising and benefits maximising' 'rational economic agent'. By assuming that humans instinctively or intuitively act in linear and predictable ways—hardly can we believe ordinary people doing all the number crunching and calculus of the economists' models in their daily decisions, thus acting 'rationally' as assumed by the models—economists can think that humans taking their economic choices always favour that which allows us to 'maximise our satisfaction while minimising the pain' as a consumer or, as producers and merchants, 'maximise our earnings while minimising the costs'. Thus, economists simply assumed that human behaviour followed linear and predictable patterns described by mathematical, linear functions. Undeterred by other scientists'

work, particularly in the human sciences, pointing to the cultural, political, economic and psychological aspects affecting human behaviour and historical dynamics. Nor bothering about anthropologists' studies of other societies and cultures pointing to how oikonomic behaviour was always affected and part of these societies' cultural values and institutional settings. Thus, economics ignores not just Nature, our shared home, *Oikos*, which sustains us, but our human nature as well.

As an example of the lengths economists may assume instead of observing and understanding real-world behaviour, we may take the example of the 'rational expectations hypothesis'. Given that uncertainty about the future was one of the central elements of Keynes' theory pointing to the expected existence of unemployment under free-market conditions—by the way, stating it in theoretical terms instead of just pointing to the great depression of the 1930s or actual unemployment which, indeed, accompanied the history of capitalism since its inception—in the 1960s, John Muth proposed the 'rational expectations hypothesis', assuming that the expectations of the economic agents, as an average, were consistent with those of the models. Thus, although no person is supposed to be doing all the number crunching of the models, it is still assumed that at the macroeconomic level, the decisions of the individuals are consistent with those of the models. That is, individuals have a rational foresight about the future and will not act out of fear or, as Keynes argued, hoard money for 'precautionary reasons'. Thus, despite historical evidence pointing otherwise, the idea of full employment under free-market conditions could once again be theoretically stated. From then on, economists could simply assume that people knew and operated according to the models' predictions, although being unaware of it. It may sound weird for those who look at human beings and human behaviour from an empirical perspective, like psychologists, anthropologists or historians do. Indeed, assuming rational expectations and perfect information may sound weird to anyone trying to understand the spending habits of his partner, his children or ourselves when we remember the last time we were duped into buying an utterly unnecessary gadget in our previous visit to a department store or, at a moment of boredom, online. But this is how economists manage to stick to their models and assume a mathematically predictable human behaviour. It has, since then, become a standard assumption in macroeconomic theory. Employing this assumption allows economists to believe that agents inside the model 'know the model' and, on average, take the model's predictions as valid. Thus, although individual agents may get it wrong, on average, all different expectations of individuals, firms and government institutions about future economic conditions level each other. Thus, although individual behaviour can be shown not to be consistent with the model's hypothesis, the model is still valid because, globally, expectations are assumed to be in line and consistent with those of the model. Said otherwise, a clever way to avoid falsifying by empirical observation: the model is proven correct because we previously assumed it to be so!

By sticking to this fiction, economists can ignore the insight into human behaviour gained by psychologists, anthropologists, political scientists or historians. Ignore the subconscious and unconscious elements of our behaviour, the social and cultural dynamics shaping it or the way group behaviour emerges. *Homo*

oeconomicus, fortunately for our model-making practice as economists, is not affected by them. Thus, but still striking to me, history, anthropology, psychology and cultural studies, not to say ecology and a better understanding of the natural world, were absent from my economics' curriculum. I did not have to study it, not even on an introductory level. Instead, I was expected to focus on mathematics, differential calculus, statistics and econometrics. For all the rest, I could just assume humans to be 'rational economic agents', and the 'ceteris paribus' condition would do the work.

Implicit in this methodological choice, but mostly invisible and ignored by economists, is another even more challenging methodological and logical tour de force which economists have accomplished: although human behaviour, as manifested by the diversity of our cultural, technological, linguistic and historical achievements, is undoubtedly the most plastic, creative and changing behaviour on Earth, it is assumed to be the most linear, predictable and straightforward among all species by the economists. For instance, even ethologists would not dare express the bee's behaviour through a linear mathematical formula. Like Konrad Lorenz famously did, some spend decades observing and living with gooses while trying to understand their ways. Instead, economists simply assumed this particular species, *homo oeconomicus*, to be the most predictable and straightforward of all behaving animals. Indeed, ethologists do not explain the gazelle's escape behaviour when chased by lions through a mathematical formula. Instead, they spend hours observing it in the wild and then other hours reflecting on their observations. But economists, except perhaps now for behaviour economists who, thanks to big data and brain-scanning techniques, started to do some empirical studies, explain how we, let's say, purchase a smartphone by assuming that we do it in purely rational and predictable ways. By reducing *homo sapiens* to *homo oeconomicus*, we humans are supposed to be short-term, money-focused, selfish individuals, acting without any kind of social, cultural and ethical constraints. But, then again, assuming that our behaviour, even in the oikonomic arena, takes into account other factors and may be changing according to social, cultural and ecological contexts, considering that we may take into account long-term considerations or empathically other's needs while acting, would have made it rather messy and impossible to include humans in the economist's mathematical models. Thus, it had to be dismissed, if not for empirical, for purely practical reasons. After all, humans' behaviour deciding whether and which new smartphone to buy is much more predictable than escaping gazelles. Or is it not?

Anyway, as aspiring economists, we were told not to bother about these questions? After all, can't we observe economic regularities emerging from the myriad of interacting factors? Of course, we can. But it is at least naïve, if not downright foolish, to pretend to understand it by looking at an abstract, simple mathematical model, applying the Newtonian method to it. Nowadays, after decades of studying all these subjects by myself, after having refused to reduce human beings and me to 'rational economic agents', and refused to consider the oikonomic process in abstract mathematical form, I still wonder how can legions of students all around the world be brought into accepting this reductionist view of reality and our human nature as

being a valid approach to the understanding of the living, historically changing and certainly complex oikonomic reality? How can we accept it as 'scientific' and even 'objective'? Why are Nobel Prizes given to intelligent model-building economists, then celebrated as great scientists at the same level as physics, medicine or chemistry, when their models depict a reality far removed from the real world, and they repeatedly fail to predict the next oikonomic crisis? Why and how had this single approach to economics, although so far removed from reality, become so hegemonic worldwide?

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Chapter 3
About Economists and Theologians

By following my PhD in social sciences at the Institute of Philosophy and Human Sciences of the University of Campinas (IFCH-UNICAMP in its Brazilian initials), an answer to this question became more apparent to me. I had previously done a master's degree in international economics in the Graduate Institute of Higher International Studies of Geneva (IUHEI in its French initials, nowadays known as just 'The Graduate Institute' after fusing with the neighbouring Development Studies Institute). While applying to the institute, I still hoped it would help me better understand the world around me, particularly our global oikonomic dynamics, once a multidimensional approach to the international reality was promised. Something which my first degree had failed to do. But it ended up opening my eyes to my practice as an economist instead. To reflect on how far removed from reality this profession has become and how this relates to our present oikonomic structures and development practices.

The international economy branch of the IUHE had a strongly neoclassic approach to economics. Thus, although it was a multidisciplinary course and we could attend classes in two of the other specialisation lines, choosing between international law, international politics and international history, my core course in economics was entirely theoretical and model-based. Although happening in the same institute and to the same students, I could experience how far from the other branches (law, history and political sciences) economics were, in both method and content. As if it were studying another world or subject. I had my classes in international history and international politics, but nothing of what I learned there ever appeared in the models I was taught in economics. Indeed, these models were assumed to be universally valid, happening as they were in a historical, cultural and political void. A place where historical and political events and cultural and institutional changes, like those I learned in the other courses, did not affect the outcomes of the models we studied in our macroeconomics and microeconomics courses. While in all other branches of the institute, other actual international realities and facts were explored and some explanatory frameworks proposed, in economics, it

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was all about learning different theoretical models and handling them mathematically. Nor was there any reference made to actual world events.

I remember how, as students aiming to specialise in international economics, we had to attend the institute a week earlier to do a crash course in mathematics to 'have a solid mathematical background to be equipped to handle the technical aspects of economics'.[1] Our teacher—a PhD student—started by presenting several famous macroeconomic models and discussing their mathematical underpinnings. Following the standard 'scientific' and 'objective' approach, the assumptions of the model were stated, like as an example, (1) aggregate demand is determined by the standard open economy IS-LM mechanism (itself the basic model studied by all economists, based on a series of non-realistic assumptions which, once hidden behind the model, need not be stated again)[2]; (2) financial markets can adjust to shocks instantaneously, and investors are risk-neutral; and (3) in the short run, goods prices are 'sticky'.[3] Based on these assumptions, a mathematical model was presented, showing—in the case of the Dornbusch overshooting model on which this example is based—that aggregate supply is horizontal in the short run while positively sloped in the long run. Once the whole model is outlined, economists (and we as students) were supposed to define mathematical relations between economic variables, such as interest rates, money supply, prices and output. Then we were asked to examine how some variables (the supposed exogenous ones) affect others (the endogenous or dependent variables of the model).

Confronted by this kind of models and method, one day, I raised my hand. I asked our teacher if, once all assumptions of the model being presented were known not

[1] As stated in the brochure we received prior to the course.

[2] The IS-LM model is a model which summarises and relates the 'monetary' or 'financial' side of the economy (money and other financial assets) and the markets of goods and services (also referred to as the 'real economy'). It rests on a series of restrictive assumptions about the short- and medium-term behaviour of interest rates, the different agent's expectations and consumer preferences and behaviour while assuming as well a closed market economy and, of course, assuming no innovation or disruptive technological, ecological or political dynamics behind its pervasive ceteris paribus assumptions. In fact, it is a model which has suffered countless criticisms over the years, including from Hicks, the initial proposer of the model based on Keynes ideas, because of its simplistic and unrealistic assumptions about the macroeconomy. In fact, Hicks later admitted that the model's flaws were fatal, and it was probably best used as 'a classroom gadget, to be superseded, later on, by something better', as quoted in Kates (2010, p. 130). Indeed, now I believe, its main virtue is to be taught and used by economists in their models and classes. A convenient way to keep them and myself busy working with models instead of observing reality. As Kates (2010, p. 129) showed just a page before, 'The old- fashioned IS–LM framework, based on the work of John Hicks, has already been thoroughly debunked—by John Hicks. (. . .) Hicks observed that theories "built upon the hypothesis of a stationary state [are] quite satisfactory under that hypothesis, but incapable of extension to meet other hypotheses, and consequently incapable of application"'.

[3] These are the summarised basic assumptions taken from a famous model by Rüdiger Dornbusch (1976), the overshooting model, which we extensively studied during our degree course. A full description of all underlying assumptions and how the model is constructed starting from them can be found directly in the paper itself, which may be consulted at https://www.jstor.org/stable/1831272?seq=1

just to be non-observable in the real world but empirically false as well, the only logical conclusion to be drawn from the model should be that, except for an incredible coincidence, in the real world the findings of the model should be expected to be false too? No matter how well we did the mathematics? I remember the quietly puzzled look I got in return before she managed to come up with an appropriate answer. After agreeing that I had a point from a purely logical perspective, she argued that this was not the real question to be considered. As economists, we were supposed to construct models, a procedure that was simply needed to create the models in the first place, present them at conferences, write a thesis about them and confront them with other models developed in the same way. As a scientist, of course, I could propose other models based on different assumptions. But at no point it was argued that maybe we should avoid the models altogether and ground our conclusions on observed reality instead. According to her reasoning and an argument that economists often repeat, the assumptions are needed to create the models in the first place and cannot be avoided. Once economics was understood as an exact, mathematical and objective science, we had to proceed that way to keep on being 'objective', 'scientific' and therefore 'neutral' economists... But no question was raised whether we should approach our subject differently, as other social scientists do, and even in the institute, the other branches of study were doing. Look at reality instead.

It did not appease my anxiety to know that some months later, having completed her highly theoretical and equations-filled PhD thesis, she went on to work at the IMF. There she joined other equally mathematically skilled and model-building economists. But, instead of just playing around in these abstract worlds as we did in our classes, they eventually team up in 'technical missions' which, given minimum time and by dint of back-breaking work, propose 'structural adjustment programmes' to entire countries like I had seen in Brazil during my youth or, more recently, Greece went through. I do not know whether she participated in that particular 'technical mission' responsible for devising the adjustment plan the Greek authorities were eventually summoned to sign unless they wanted to be cut off from international financial markets. But those who did probably had similar training and background. Nor were they asked to have an understanding of Greek history, culture, institutional framework and politics. Just sticking to the models and feeding them with numbers would do, once all these variables were assumed to be unchanging, ceteris paribus, thus thought external to the models. Thereby, nowadays, we have strangers telling a democratically elected government what to do if it wishes to survive in the face of its debt crisis. They are not grounded on a deep understanding of the local reality but based on the outcomes of abstract models and theories whose validity is deemed to be universal. Although, as she conceded, being based on unrealistic and false assumptions, we should not expect the effect on the Greek reality to be in accordance with the theoretical outcomes of the plan.

Notwithstanding, these plans are imposed with the same air of truth, superiority and disdain for the local reality as when the European explorers brought the Cross to convert those they found to their faith without even bothering to know their faith and beliefs first. Like those early missionaries, those economists working for the IMF

may see themselves as just bringing this superior knowledge about the economy to these countries and governments in need.

Indeed, using the term 'mission' to these procedures may be not just a coincidence but a reflex of the arrogant superiority felt by many 'experts' and particularly economists after having worked hard to learn the hidden secrets of the economic doctrine revealed by the different models. It may be fitting to remember how a feeling of doctrinal superiority has always imbued the spread of Western European society to the rest of the world. From the medieval crusades promoted by the Vatican to the marriage of Crown and Church, which fuelled the Iberian conquest of America, aiming to both plunder indigenous wealth and convert indigenous souls to the Catholic faith. Even slaves brought from Africa to America were seen to be saved from the risk of eternal damnation by being baptised into the Christian faith before being shipped. Or how, well entered the nineteenth century, the Anglo-Saxon 'white man's burden' to spread progress by force if necessary helped to legitimise European colonial expansion around the world.

'Missions' may be more than the simple use of the same word to designate the twentieth-century 'technical missions' aimed to bring development—now basically reduced to the aim of fostering chrematistic growth—and the missions of those who 'heard the good News' to spread the Word to those who have not. Although much more hidden, it still bears the same moral imperative of extending the right faith and gospel to the world or, as stated nowadays in the 'Millennium Goals', to 'fight against poverty' by fostering the development of those 'underdeveloped' countries. In all these cases, both personal interest and a moral imperative lead these 'missions' to convert the others to the 'superior faith' and 'path to salvation'. No one asks what this faith actually is and whether it is justified. In the case of the IMF missions, faith in economics as a science, belief in the virtues of free markets and the sacrosanct aim of increasing chrematistic growth. . .

Mocking the use of unrealistic assumptions to build our models, in our classes in international macroeconomics, whence presented with a model and being asked, for example, what would happen if, as a recurrent example, there was a 10% increase in the money supply thrown from helicopters on the economy,[4] I proposed a standard answer which sometimes we used for fun: 'under the right assumptions, nothing happens. . .'. For instance, in this case, I liked to suppose that a stroke of lightning would burn the paper money before touching the ground in a beautiful firework

[4]This example was first suggested by Milton Friedman (1969, pp. 4–5), when he argued that money should be given directly to households in order to stimulate the markets, similar to Keynes' idea to bury money in bottles and thereby stimulate the oikonomy by the creation of a 'bottle mining industry' and the resulting mined fresh money in the oikonomic process. Although not tested in practice—except maybe for cryptocurrencies such as bitcoins, which are actually 'mined' in the virtual world—this is another favoured assumption made in order to study models once, among other advantages, it simplifies the models by showing a direct net increase in the money supply variable and not, as happens in actual quantitative easing standard economic policy, where money supply is increased by the central bank buying government bonds, thereby affecting the interest rate also during that process.

display, thus not affecting the economic activity any further. Why not? It sounds as plausible to me as assuming that we have 'perfect information' whence buying a new smartphone or asking for another beer. Or, as in the case of the Greek government, believing that things would turn out as expected by the adjustment plan they were forced to sign.

These experiences and working my way through sophisticated models and struggling to handle their mathematics instead of looking at the world around us made me realise that 'economics' and 'economy' are not just slightly different words but are worlds apart. How could it be, I wondered, that something so far removed from actual reality was still professed and recognised as a science by so many intelligent, respectable people worldwide? Talking to a brilliant and sensible good friend of mine in the pauses between classes, I asked him how he felt about us dedicating so much time playing around with models with little or no relation to the real world instead of learning how to get to grips with it? I still remember his answer: although fully agreeing with me, he told me that to fulfil his dream to become and be recognised as an economist, to follow his PhD studies and his career as a teacher and researcher in economics (his main project at that time), this was what he had to do. Indeed, he was right, and thus he went on pursuing his PhD. Nowadays, he is a Division Chief at the International Monetary Fund and has published plenty of well-argued, model-based papers in international economics. I do not know how much he believes in them and their relevance to the real world. But that is what he had to do to advance his career and what he is supposed to keep doing if he wishes to build up his professional prospects.

Along the same lines, I remember once meeting a student at the university's cafeteria. After hearing that he had studied theoretical physics but had decided to follow a PhD in economics, surprised I asked him why he changed his subject that radically. His answer was plain and simple: 'I wish to earn a Nobel Prize and realise that, given my mathematical skills, my chances of doing so in economics instead of physics are much higher'. I had to agree with him. Once economics is defined and accepted as a clever model-building practice, instead of its empirical relevance, a mathematically skilled physicist has undoubtedly better chances than me to gain recognition and praise as an economist. After all, Stanley Jevons (1879, p. xiii), one of the founding fathers of modern neoclassic economics, had already suggested that 'I do not write for mathematicians, nor as a mathematician, but as an economist wishing to convince other economists that their science can only be satisfactorily treated on an explicit mathematical basis. When mathematicians recognise the subject as one with which they may usefully deal, I shall gladly resign it into their hands'. Should this fellow I meet manage to propose 'a theory of everything' in economics instead of trying to do it in physics—unifying microeconomics and macroeconomics, for instance—or write a 'general theory' of economics like so many economists have been attempting to do, he would certainly be well placed in the profession. With the advantage that no one would be able to refute his models. While experiments and observations in physics are made to verify given assertions and predictions of the theoretical models, these experiments are impossible and not even attempted to be made in economics.

Notwithstanding, I had not yet grasped the full ideological implication of this practice at that time. But gradually, I came to see it. Instead of helping us understand and represent reality as it is, economic theory is presented as a guide and model to what it could be if only we made the needed reforms. Most models point to general equilibrium, maximum individual and collective welfare (in economics, it is called 'Pareto optimality' following the theories and models of Vilfredo Pareto) and full employment, except for the Keynesian models pointing to the need for government intervention in the markets. Thereby, given these positive outcomes, it is easy to conclude that the world should be as balanced and harmonious as depicted in the models if only the world conformed to the models. Being based, as they are, on the assumptions of free-market competition and 'rational' human behaviour, it is easy to argue that if in reality markets were free, competition was promoted and people based their decisions purely on chrematistic calculus and prices, the world would be a better place. Thus, instead of the models being replaced once not observed in practice, the reality has to be conformed to the models to have full employment, welfare and 'economic efficiency'. Thus, for instance, whence subjected to the 'structural adjustment plans' imposed by the IMF to have access to the international credit again, the first thing that is asked is reforms, reducing government regulations and interventions, thereby promoting more 'market freedom and efficiency'. Moreover, it allows for a simple answer whenever the result of the undergone 'structural adjustment' and 'reforms' is not as expected by the models: it is not the plan that was based on false and unrealistic assumptions, but it is the country that has not yet advanced enough in the direction signalled by the plan's assumptions. It has not yet advanced enough in its reforms.

Thus, there is a perverse twist to the argument. Although presented as scientific and showing all its scientific credentials by basing itself on the mathematical, analytical method, economic theory and models function as ideological constructs pointing to how the world should be. Not on how it is. Thus, economics in the way it is professed has to be seen not as a science but as an ideology. Like any ideology, it signals an ideal world not yet existent or informs us which direction to go and how to behave. Economics does not show how things are. But, as students, we were mainly occupied with learning how to act to get our grades—gradually accepting that this is all we have and can do, not having learned to approach the oikonomy otherwise. Thus, in a certain sense, we were being trained to become the advocates of this particular ideology.

We like to think about ourselves as 'rational' and 'reasonable'. Believe that objective thinking allows us to detach ourselves from our subjectivity and emotions. But we forget that, more than rational, we are rationalising beings. I remember how, as a teenager, I knew that I was able to justify almost any attitude and behaviour I engaged in, from innocent petty shoplifting to misbehaviour in school trying to impress my schoolmates or just give way to some inner emotional tension. I still can, particularly when I feel my self-image and ego threatened by someone else, enter into an argument and eagerly defend my subjective opinions believing them to be objective facts instead. Indeed, we humans, being self-reflective and potentially

conscious of what we do, need to understand and justify it—in others' eyes and to ourselves, not wanting to carry a heavy consciousness on our shoulders.

Thus, we do as did slave owners in the past for imposing their will on slaves finding justifications to their behaviour. We do so mainly at a subconscious level every time we do something. From our eating habits to our behaviour as consumers, although possibly consuming our way towards social and environmental collapse, we believe that, at a personal level, we are doing the right thing given the circumstances. Despite our beliefs and understandings about human-related climate change, we may and can always find good reasons to take long-distance flights. Be it just travelling for a holiday, having a business meeting, visiting our family or even participating in an international conference on climate change. At least I do, often catching myself stopping short from inquiring further in certain subjects knowing that it would hinder my behaviour. I became vegan some years ago for many reasons, at least in theory following my present understanding and consciousness. But sometimes, to enjoy a good fish or, more importantly, a good dinner with friends, I will simply close my eyes and enjoy it. Without asking myself too much about it. And there are plenty of reasons I can find to do so.

Like any other organ we have, our mind's primary function is to ensure our survival. Not objectively inquire into the ultimate reality of the universe or the deeper meaning of life. It may occasionally do so, but we have to act and behave more than simply and patiently meditate about it to survive. More than understanding reality, we need to adapt and behave to ensure our survival in this reality. That is how we, as a species, managed to survive and evolve. If confronted with a lion or other predator in the wild, it may be better to protect and secure ourselves from a survival and evolutionary point of view. However little harm this specific predator would pose if he happens to be satiated and calm. To take our time to 'objectively and rationally' figure out whether this particular lion is a threat or not may not be a good option if he happens to be hungry. Thus, as aspiring economists, it may be better to rationalise our way into professing our profession the way we do, instead of inquiring too much, ending up living at the margin of the profession as it happened to me. Monty Python, the famous British comedians, has a hilarious sketch of what would happen if football was played by thinking philosophers instead of active players. If you wish to win a football match, you rather do not try to philosophise too much about its virtues and innermost nature. . . .[5]

Standard objectivist modern science forgets that the world we 'see' is not merely a linear sum of the perceived inputs we receive from our senses. Reality and what we actually 'see' is always a projection and creation of our mind. We do not 'see' a lion or a tree just through our eyes. Instead, according to the signals received by our mind, our inner beliefs and our past experiences, we project an internal image and perception on that which we see. Perception is active, not passive. Simultaneously,

[5] The sketch features a hypothetical football final between Greek and German philosophers and is largely available on YouTube under titles like 'the Philosophers World Cup' https://www.youtube.com/watch?v=92vV3QGagck

our mind and inner mental processes have been selected by evolution according to how they managed to help us adapt and behave in different and changing environments. When we 'see' a stone being thrown towards us, we project it slightly closer than our eyes perceive. This gives us the extra needed reaction time to avoid its impact. When we first throw a ball to a young child, he will not catch it, as he misses the kick when first playing football. We all have first to learn how to project the reality so that the movement of the different elements is rightly predicted and thus coordinate the activity of seeing and doing. Indeed, our mind is continually learning how to project a reality so our behaviour may adapt and fit into the different personal and cultural contexts we may be. But there is a price to be paid for it: our mind projects a reality and rationalises our behaviour, making us prone to adopt as 'truths' abstract ideologies and models learned in the past. It allows us to adapt to given environments. But once the environment changes, we may stick to rationalisations, theories and ideas that no longer hold into this new reality. Just as we may cling to emotional patterns and behaviour that once helped us survive but no longer enable us to lead a happy and fulfilled life.

This is what may be happening now with our modern economic theories and way of seeing reality. We stick to a worldview that has brought us until here but may not help us address the present reality and lead us towards a better future. We mistake theories and ideologies for reality, prices for value and chrematistic growth for oikonomic development. Believe that we are getting more prosperous when we may be destroying our environment and generating more social polarisation and violence instead. This is what our mind does, although absurd some justifications, seen from the outside, may seem. It is what happens once we start to take our projections for reality instead. Believe that what we 'see' is given objectively by our eyes and not an image we create ourselves. Do not realise that every 'seeing' is a hypothesis about reality, not reality as such.

But, particularly in times of changes and new challenges, we eventually have to reconsider our beliefs and convictions. Look to reality in new ways and find new paths. That is what happened, for instance, in the fifteenth- and sixteenth-century Europe when a new reality was emerging and our modern world came into being. Old beliefs and ways of looking started to be questioned. New ones appeared.

'Eppur si muove'[6] Galileo is quoted having said after being found 'vehemently suspect of heresy' by the Roman Catholic Inquisition for sticking to his observations and conclusions that the Earth circles the sun and not the other way around as assumed by the Church's accepted dogma. His telescopic observations, made public in 1610 in his *Sidereus Nuncius* (*The Starry Messenger*) describing the moon surface with his valleys and mountains, the planet phases of Venus and Jupiter (which implied them as well circling the sun) and all other evidence he described like Jupiter's and Saturn's moons circulating these planets, they were all considered heresy at the eyes of the Church. The argument went on for many decades, and

[6] 'Still it moves'.

despite the empirical evidence supporting Galileo, he was condemned in 1633 to lifelong imprisonment, commuted to house arrest until he died in 1642.

Many church astronomers repeated Galileo's observations. But instead of arriving at his conclusions, they went on complicated arguments to reconcile them with the accepted geocentric view. Others directly refused to look through the telescope, as Galileo complained in a letter to Kepler: 'My dear Kepler, I wish that we might laugh at the remarkable stupidity of the common herd. What do you have to say about the principal philosophers of this academy who are filled with the stubbornness of an asp and do not want to look at either the planets, the moon or the telescope, even though I have freely and deliberately offered them the opportunity a thousand times? Truly, just as the asp stops its ears, so do these philosophers shut their eyes to the light of truth'.[7]

Unlike Galileo, Newton, who built on his method and followed his observations, was seen as a God and hailed as a hero still during his lifetime. At his death, the poet Alexandre Pope proposes in his epitaph intended for him to state: 'Nature and Nature's laws lay hid in night: God said, Let Newton be! and all was light'. Although this epitaph was finally not approved, a more extensive inscription in the Westminster Abbey where 'lies that which was mortal of Isaac Newton', nevertheless, points to the same fascination and perspective: 'Here is buried Isaac Newton, Knight, who by a strength of mind almost divine, and mathematical principles peculiarly his own, explored the course and figures of the planets, the paths of comets, the tides of the sea, the dissimilarities in rays of light, and, what no other scholar has previously imagined, the properties of the colours thus produced. Diligent, sagacious and faithful, in his expositions of nature, antiquity and the Holy Scriptures, he vindicated by his philosophy the majesty of God mighty and good, and expressed the simplicity of the Gospel in his manners. Mortals rejoice that there has existed such and so great an ornament of the human race! He was born on 25th December 1642, and died on 20th March 1726'.[8]

Thus, at the time modern economics was born, modern science had already taken the upper hand. Theology having been relegated to a minor role, the Bible and inherited texts being read not as factual descriptions of reality but according to their symbolic and spiritual meaning. In this context, Adam Smith wrote the founding book of modern economics, *An Inquiry into the Origin and Causes of the Wealth of Nations.* Following him, as we saw in the previous chapter, it was in the mathematical, model-based deductive method proposed by Galileo and Newton that modern economists would seek advice on approaching reality 'scientifically'. Even if at the price of greatly simplifying and reducing reality and ultimately ignoring it by introducing the ceteris paribus condition. However, economists never asked

[7] From the Latin original source, quoted in Wikipedia https://en.wikipedia.org/wiki/Galileo_affair and Favaro (1890/1909).

[8] Available online 17 May 2017: http://www.westminster-abbey.org/our-history/people/sir-isaac-newton