

Bachelor Thesis

**Fortunetelling in economics
and the promises of quantitative methodology**

Hanna Plewnia

Student Number: 60064
Program: BA Philosophy of Specific Discipline
Main Discipline: Economics & Business Economics
Supervisor: Dr. Laura Garcia-Portela
Advisor: Prof. dr. F.A. Muller

Wordcount: 9955
Completed on: 14.07.2025

Table of Contents

- Introduction 3
- 1. The rise of (over-)quantification 7
 - 1.1 The status quo 7
 - 1.2 Retracing the steps 9
 - 1.3 Digging deeper 13
- 2. The promised land 15
 - 2.1 The nature of neutrality 16
 - 2.2. Perceived objectivity 19
 - 2.3. Fictitious certainty 22
- 3. The fall from grace 25
 - 3.1 Oversimplification and mindset constraints 25
 - 3.2 Enshrouded biases 26
 - 3.3 Accountability gap 28
- Conclusions 29
- Bibliography 31

Introduction

In 1973 Fischer Black and Myron Scholes published a groundbreaking article in the *Journal of Political Economy* entitled: “The Pricing of Options and Corporate Liabilities,” in which they introduced a model for the valuation of stock options, still used in finance today. As defined by the Authors, an option “is a security giving the right to buy or sell an asset, subject to certain conditions, within a specified period of time.”¹ Simply put, one can acquire an option to buy or sell an asset at an agreed upon rate sometime in the future, which protects the buyer from market fluctuations of the said asset’s price. Black and Scholes focused on the simplest form of such a security, referred to as a “call option,” which grants its holder the right to buy a single share of a stock. After comparing their theoretical predictions with the actual prices, the researchers found a pattern showing that there was a tendency for option sellers to profit more than option buyers, which indicated mispricing.² If, like the model claims, the options are mispriced, an opportunity for arbitrage arises, i.e. a chance to exploit price differences for profit. The formula, later extended by Robert Merton, has proven to be so successful that it became widely adopted in the financial sector and served as a guide for pricing not only options, but also other types of more complex derivative products.³

Nevertheless, the model's extraordinary success came with considerable dangers. Despite its reliance on a set of idealized assumptions, which Black and Scholes outlined in the original paper, such as constant market volatility and no transaction costs,⁴ the model came to be treated not merely as a useful tool, but as a representation of financial reality. As Thompson notes, the model became a self-fulfilling prophecy – instead of externally representing market forces it began to force the market, influencing the behavior of traders and the prices. The use of the model meant performing it and concurrently making it correct.⁵ Even as the market crashed on Black Monday

¹ Fischer Black and Myron Scholes, “The Pricing of Options and Corporate Liabilities,” *Journal of Political Economy* 81, no. 3 (May 1973): 637, <https://doi.org/10.1086/260062>.

² Erica Thompson, *Escape from Model Land* (John Murray Press, 2023), 116.

³ Tim Harford, “Black-Scholes: The Maths Formula Linked to the Financial Crash,” *BBC News*, April 28, 2012, <https://www.bbc.com/news/magazine-17866646>.

⁴ Black and Scholes, “Pricing of Options,” 640.

⁵ Thompson, *Model Land*, 117.

in October 1987, the formula was not abandoned. Rather, the model was improved by more complex calculations, however even in its simple form it continued to function as a benchmark of judging derivatives.⁶ Moreover, in 1997 Scholes and Merton received a Nobel Prize in Economics for their invention.⁷

Meanwhile, the shortcomings of the formula, which after the 1987 market crash had been attributed to the formula's technical specifications, might have been rooted elsewhere. Ian Stewart suggests the problem was the formula's potential for abuse, because it "allowed derivatives to become commodities that could be traded in their own right."⁸ The model paved the way for trading increasingly complex financial instruments with questionable value and risk profiles. Moreover, it also changed the culture of finance to include more computational decisions in hopes of exploiting mathematics for profit.⁹

An embodiment of that trend was Long-Term Capital Management (LTCM) – a high-risk hedge fund established in 1994, where investment decisions were based on mathematical principles such as the Black-Scholes equation. At the beginning it was a highly successful endeavor and as Allington et al. state "for a few years LTCM offered investors spectacular returns" reaching 43 percent in 1995.¹⁰ Interestingly, Myron Scholes and Robert Merton were members of the fund's directorial board, but even the expertise of the Nobel laureates was insufficient to substantiate LTCM's name and guarantee its long-term success. The hedge fund nearly collapsed in 1998, less than a year from the Nobel Memorial Prize being awarded to Scholes and Merton. LTCM was subsequently bailed out by 14 main counterparties, due to its size, or more precisely – due to its interconnectedness with US banking institutions.¹¹

⁶ Thompson, 120.

⁷ Nigel F. B. Allington et al., "Lessons Not Learned: From the Collapse of Long-Term Capital Management to the Subprime Crisis," *Journal of Post Keynesian Economics* 34, no. 4 (July 1, 2012): 557, <https://doi.org/10.2753/PKE0160-3477340401>.

⁸ Ian Stewart, "The Mathematical Equation That Caused the Banks to Crash," *The Guardian*, February 12, 2012, <https://www.theguardian.com/science/2012/feb/12/black-scholes-equation-credit-crunch>.

⁹ Harford, "Black-Scholes."

¹⁰ Allington et al., "Collapse of Long-Term Capital Management," 559.

¹¹ Allington et al., 559-560.

The case foreshadowed what such practices in finance may lead to, if they remain unchecked. Unfortunately, the lessons from the incident were not learned, as there was very little change in financial regulation and the crucial assumptions, such as the efficient market hypothesis and ergodicity, were not revised.¹² As Campanario and Lara write "notice was apparently taken of the danger of trading using a model in a world where the assumptions contained in formula underlying and underpinning the model did not hold, but it was promptly forgotten, ignored and obviated."¹³ Thus, some scholars claim that the legacy of the Black-Scholes model was an indirect reason for the 2008 market crash.¹⁴

This case exemplifies the inherent power that quantitative practices have when applied to real world phenomena. The lack of prudence in the application of economic models, although possibly profitable in short term, may have devastating consequences. If choices made on paper affect people's lived reality, they should be assessed with great caution. Examples of misusing models require asking whether mathematics is overused in economics to the detriment of qualitative assessments or why such heavy reliance is placed on quantitative methodology in economic science. It is thus justified to focus on the underlying intricacies of quantitative methodology in economics. The research question I pose is: What are the causes and implications of over-quantification within the field of economics? The question is twofold, because the origins of over-quantification are a necessary, initial consideration that provides the basis for assessing its implications in economics. This further allows for a comprehensive analysis of arguments in favor, as well as to the detriment of over-quantification.

The topic of over-quantification is scientifically relevant as it relates to the current methodological practices in economics. Moreover, it supplies a clear link between economics and philosophy, given the epistemological implications of these prevalent practices. Philosophical exploration of the social and scientific impact of quantification is crucial for understanding economics, allowing for critical assessment. I believe the methodology and the underlying, often obscured or

¹² Allington et al., 557, 568-569.

¹³ M. L. Campanario and J. A. Lara, "Lessons Learned from the Misuse of Mathematical Models: The 2008 Financial Crisis," in *AIP Conference Proceedings*, vol. 1618 (AIP Publishing, 2014), 761, <https://doi.org/10.1063/1.4897843>.

¹⁴ Allington et al., "Collapse of Long-Term Capital Management," 568.

disregarded, assumptions implicitly made while employing quantitative methods are of crucial importance not only to the academic output but also to the way we conceive the economy. An in-depth analysis of seemingly innocent technical choices lends an opportunity to discuss the unavoidable value judgements and the normative aspects of economics, bringing a more nuanced perspective. Moreover, as economic theories and models are widely used in policymaking and business practice, the relevance of this topic extends beyond academia.

The above considerations require dividing the argument into three main chapters. Firstly, by using the example of cost-benefit analysis, it is shown that over-quantification is prevalent in economics. The historical development of quantitative methodology within economics is explored to identify and understand the factors and reasons contributing to its permeation into the core of the economic discourse. Afterwards, the phenomenon of quantification is discussed in more detail showcasing its transformative power. The second chapter is devoted to analyzing the epistemic promises of quantification, namely that of neutrality, objectivity and certainty. In the last chapter, the practice of overreliance on quantification is problematized, and undesirable consequences of the prevalent epistemic beliefs are considered. The thesis ends with concluding remarks containing an overview of the key points made throughout the thesis and a final assessment of reliance on quantification in economics.

This overview of content may prompt some to view the thesis as a too long story about the introduction of quantification into economics followed by an un-structured parade of items challenging the objectivity of economic sciences.¹⁵ Even if one agrees with such view, I still hold that the argument is viable and has merit. The exploration of the historical progress of methodology and thought as well as the analysis of the intertwined epistemological beliefs within economics are integral to demonstrating the problematic assumptions and practices around quantification present in economics to this day. Consequently, the parade of items disputing the objectivity of economic sciences should not be underestimated, as it neatly reflects the variety of perspectives which expose the challenges in the application of economics to the benefit of the society.

¹⁵ Comment made by the Advisor on the first draft of this thesis

1. The rise of (over-)quantification

To begin tackling the topic at hand one must first ask what the current status of quantification within economics is. Since I aim to make a claim that quantification is overused, a case for prevalence of over-quantification needs to be made. Hence, I begin with depicting this phenomenon and then seek to show how this status quo came about, by describing and analyzing the historical thought progression that led to the methodological choices and assumptions favored by today's economist. The fact that economics has become so quantitatively oriented is at least somewhat surprising, which prompts the investigation into the origins of over-quantification. Afterwards a more detailed analysis of quantification is presented to highlight the dangers of increasing reliance on quantitative methodology. These deliberations establish the foundation for subsequent chapters, focused on the epistemic implications of over-quantification.

1.1 The status quo

There seems to be a common perception that economics is inherently mathematical.¹⁶ Somehow, this field of study became identified with quantitative methods and techniques, like e.g. assessing market behavior in terms of utility functions and indifference curves or performing regression analyses to discover correlations or causal chains between economic factors. In this process, the human element has been abandoned or neglected,¹⁷ upsetting the balance in the use of computational tools, necessary to avoid excessive reliance on quantitative methodology. Thus, the term 'over-quantification' denotes pervasive and unwarranted or not sufficiently nuanced use of quantitative methods.

A poignant example of overreliance on quantification is the application of the cost-benefit analysis, especially for decision and policymaking. In the United States of America, federal agencies are

¹⁶ Philip Mirowski, "The Unreasonable Efficacy of Mathematics in Modern Economics," in *Handbook of the Philosophy of Science Volume 13 Philosophy of Economics*, ed. Uskali Mäki (Elsevier, 2012), 159.

¹⁷ Theodore M. Porter, "The Culture of Quantification and the History of Public Reason," *Journal of the History of Economic Thought* 26, no. 2 (June 2004): 166, <https://doi.org/10.1080/1042771042000219019>.

required by law to conduct a cost-benefit analysis in the regulatory process.¹⁸ The method is straight-forward, involving quantifying costs and benefits and assessing whether the latter outweigh the former. To conduct such an assessment, one needs to look through the quantitative lens and see reality as organized and simple, then select the applicable costs and benefits, and finally count what can be counted. The resulting number will predict, or rather prophesize, the success (or failure) of the project. Or will it?

Despite its prevalence and use almost as an industry standard for any economic-related decisions, cost-benefit analysis has been heavily criticized. Many authors have noticed that some costs and benefits are difficult, if not impossible, to quantify, we may not have full knowledge of what constitutes a cost or a benefit, and the components may not be commensurable.¹⁹ Take, for example, an evaluation of a project to build a new bridge. To conduct a cost-benefit analysis one should take into account the costs of construction materials, labor costs, the cost of closing nearby thoroughways to enable the construction, price the increased congestion and inconvenience for the travelers during construction, maybe factor in the opportunity cost for the next best alternative investment, value faster travel time and convenience of the commuters etc. This illustrates how some factors influencing a given decision are complex and pose difficulties for quantification.

Even in the application of the cost-benefit analysis, there have been diverging estimates and conflicting advice for the same problem, as in the case of the 2005 U.S. Environmental Protection Agency regulation imposing limits on mercury emissions from coal-burning power plants.²⁰ The legislation was criticized for its leniency, which was excused by the Agency on the basis of their cost-benefit estimates. It was calculated that more aggressive controls would incur costs of US\$ 750 mln per year and bring, an in-comparison meagre, public health benefit of US\$ 50 mln per year. Hence, the introduction of a more stringent law could not be justified. Meanwhile, Harvard Center for Risk Analysis conducted their own cost benefit-analysis which yielded an opposite

¹⁸ Maeve P. Carey, “Cost-Benefit Analysis in Federal Agency Rulemaking,” *Congressional Research Service*, November 28, 2024, <https://www.congress.gov/crs-product/IF12058>.

¹⁹ Cass R. Sunstein, “The Limits of Quantification,” *California Law Review* 102, no. 6 (December 2014): 1375–1376, <https://heinonline.org/HOL/P?h=hein.journals/calr102&i=1421>.

²⁰ Cynthia Bergman, “EPA Announces First-Ever Rule to Reduce Mercury Emissions from Power Plants,” *United States Environmental Protection Agency*, March 15, 2005, https://www.epa.gov/archive/epapages/newsroom_archive/newsreleases/91ab7266e65751b985256fc50067d9b0.html.

result, estimating the public health benefit at US\$ 5 billion a year.²¹ With such discrepancy between the outcomes, one can question the efficacy and implied objectivity of the cost-benefit analysis. All of this suggests that simply relying on numerical expression for evaluation and decision-making purposes is insufficient, or even inadequate. What is more, this case shows not only how powerful quantitative analysis can be, but also uncovers its dependency on the assumptions and methodology applied.

Such practices in economics raise the question whether the trend to mathematically assess economic reality is a novel development, or a ‘natural’ tendency present in this field of study from its very beginning. In other words, it is vital to explore, if economics has always been quantitatively oriented. If so, it is equally important to determine what factors and processes contributed to the acceptance of this particular economic paradigm. The aim of the remainder of this chapter is thus to explore how and why economics came to be predominantly comprehended as a science with an innately mathematical character. Retracing the most significant developments in economics over time will not only facilitate understanding why mathematics became such an important, arguably defining, characteristic of economics, but also whether this phenomenon emerged because of necessary developments, or as a result of accidental or convenient assumptions and processes that have since been accepted as true and indispensable.

1.2 Retracing the steps

The history of economics is inevitably linked to the progress in science in general. Therefore, an overview of the development of economics demands sensitivity to changes in a broader, scientific context. It is important to note, that the discipline first developed as a branch of moral philosophy and was later transformed by scholars with varying fields of expertise, ranging from philosophy to mechanics, physics and engineering, making its distinct identity a relatively recent achievement.²²

²¹ Denise Caruso, “The Myth of Cost-Benefit Analysis,” *Strategy+Business*, February 26, 2008, <https://www.strategy-business.com/article/08103>.

²² Kenneth E. Boulding, “Economics as a Moral Science,” *The American Economic Review* 59, no. 1 (1969): 1, <https://www.jstor.org/stable/1811088>; Theodore M. Porter, *Trust in Numbers: The Pursuit of Objectivity in Science and Public Life* (Princeton University Press, 1995), 52-59; Joseph J. Spengler, “On the Progress of Quantification in Economics,” *Isis* 52, no. 2 (June 1961): 260, <https://doi.org/10.1086/349472>.

What is particularly notable about the development of science in relation to economic thought is the rise of physics, mechanics and mathematics in the 17th century and their subsequent success as academic disciplines. This progress not only contributed to the rise of natural sciences but also led to the development of social sciences.²³ Among the highly influential figures of that time was Isaac Newton whose ideas and method greatly impacted Enlightenment thinkers. Newton's system furthered seeing nature as orderly and governed by strict mathematical laws. It also entailed a vision of humanity as capable of empirically discovering those laws.²⁴ Later, the application of these beliefs and the analogies from classical physics and mechanics in other domains was named the Newtonian paradigm. Notably, this paradigm exemplified the 17th and 18th century thought and the conviction that the complex nature can be described and understood in terms of simple formulations. Moreover, it also exposed the framing of phenomena as independent of the observer, exhibiting stable and universal, natural laws.²⁵

Adam Smith, popularly considered to be the founding father of economics,²⁶ was one of the scholars who held Newton and his method in high regard.²⁷ Some academics claim the influence was so strong that Smith's economics mirrored Newtonian physics.²⁸ Most notably, the idea behind Smith's 'invisible hand,' i.e. the balance of forces producing an equilibrium, reflects the principles of Newtonian mechanics.²⁹ Importantly, this concept still prevails in economic discourse and, as Vogl states, is the guarantor of the systematicity of economic knowledge.³⁰ To this day, it is generally assumed, in a physics-like manner, that forces of the market lead self-interested agents to produce stability and welfare, creating an order out of the disordered reality. Apart from Smith,

²³ Spengler, "Progress of Quantification," 263.

²⁴ William Bristow, "Enlightenment," in *Stanford Encyclopedia of Philosophy* (Stanford University 1997–), published August 20, 2010; last modified August 27, 2017, <https://plato.stanford.edu/archives/fall2023/entries/enlightenment/>.

²⁵ Walter A. Weisskopf, "The Method Is the Ideology: From a Newtonian to a Heisenbergian Paradigm in Economics," *Journal of Economic Issues* 13, no. 4 (December 1979): 870, <https://doi.org/10.1080/00213624.1979.11503709>.

²⁶ Boulding, "Moral Science," 1; Leonidas Montes, "Adam Smith: Real Newtonian," in *A History of Scottish Economic Thought*, ed. Alexander Dow and Sheila Dow (Routledge, 2006), 102, <https://doi.org/10.4324/9780203486238>.

²⁷ Montes, "Adam Smith," 103.

²⁸ Montes, 102.

²⁹ Joseph Vogl, "The Sovereignty Effect: Markets and Power in the Economic Regime," *Qui Parle* 23, no. 1 (2014): 134, <https://doi.org/10.5250/quiparle.23.1.0125>.

³⁰ Vogl, "Sovereignty Effect," 133.

other early economic thinkers also adopted the Newtonian paradigm, including Leon Walras, Francis Edgeworth and William Stanley Jevons, all of whom openly embraced taking inspiration from physics in their works.³¹ Since, these men were trained in physics, the appropriation of a physics-like methodology is hardly surprising.³² Undoubtedly, this epistemological frame had a bearing on the direction economics took. However, whereas in physics assuming that the objects of inquiry are independent of the observer and tractable in terms of simple and stable laws may be unproblematic, the same cannot be said for economics without serious reservations. The applicability of the physics prism to economics is, or at least should be, more controversial, as even intuitively one can imagine that economic phenomena cannot always be approached as empirically independent and exhibiting stable properties.

Along with the physics-driven frame of mind came the methodology, causing a wide variety of mathematical techniques to be imported into economics. It was not only a convenient import, but also a cunning one – mimicking physics was meant to hasten the development of the study and grant it the sought after, unshakeable scientific status. According to Mirowski, the first concepts borrowed from physics included ‘equilibrium,’ determined by constrained maximization (see the comment on Smith above), the notion of ‘utility,’ mimicking potential energy, and equating ‘commodity space’ to n-dimensional Euclidean space.³³ The numerous formalisms borrowed from physics furthered the perception of economic phenomena as having stable properties and being governed by discoverable, universal laws, further aligning with the Newtonian paradigm.

Nevertheless, despite the prominence of practices mimicking physics, the beginnings of economics as a science have been more qualitative than quantitative. Mercantilist writings and later those of Adam Smith and François Quesnay can be classified as essentially qualitative in character.³⁴ Notably, Smith’s *Wealth of Nations* was a volume published as a part of his moral philosophy course.³⁵ Some sources even suggest that he was openly skeptical about the use of overly

³¹ Mirowski, “Efficacy of Mathematics,” 170.

³² Philip Mirowski, “The When, the How and the Why of Mathematical Expression in the History of Economic Analysis,” *Journal of Economic Perspectives* 5, no. 1 (February 1, 1991): 147, <https://doi.org/10.1257/jep.5.1.145>.

³³ Mirowski, “Efficacy of Mathematics,” 170.

³⁴ Spengler, “Progress of Quantification,” 269.

³⁵ Vogl, “Sovereignty Effect,” 134.

complicated mathematical formulations in economics.³⁶ Additionally, what also testifies to the qualitative nature of the field is the fact that economics remained classified as a branch of moral philosophy for a long time, arguably even until the 20th century.³⁷ According to Spengler, up until the 1890s, the study was primarily qualitative although exhibiting a tendency for more mathematization.³⁸

Consequently, it is compelling to establish what caused quantification to gain popularity and tighten its grip on economics after 1890. According to Spengler, by that time many of the methodological differences between the existing schools of economics (i.e. the classical, the historical, the Austrian, the Marxian, the neo-classical) had been unified and most concepts in use had been clearly defined.³⁹ Moreover, he also mentions that quantitative techniques had been improved and continued to advance rapidly, coupling with the increase of the number of people familiar with and enthusiastic about these methods.⁴⁰ Furthermore, economics as we know it now, i.e. heavily dependent on models and predictions, has taken that shape around 1950s, when modelling became the standard of economic enquiry.⁴¹

Interestingly, the progress in mathematical techniques was not solely driven by technical ambitions of the scholars. A prime example of normative agenda interwoven with scientific progress is Karl Pearson's contribution to statistics. Cited as a champion of this field, his ambitions were much greater than that of technical sophistication. He strived to further an ideal of general education by following science in a manner allowing for both intellectual and moral development.⁴² Pearson claimed that scientific education would be suitable for both scientists and non-scientists, as he believed that apart from technical training it could also provide moral direction. In this framework, method was seen as a way for free thinkers to expel interestedness and seek truth. Hence, education in science, as he imagined, should play an essential role in the formation of citizens.⁴³ This is a

³⁶ Montes, "Adam Smith," 111.

³⁷ Porter, "Culture of Quantification," 172.

³⁸ Spengler, "Progress of Quantification," 269.

³⁹ Spengler, 269.

⁴⁰ Spengler, 269-270.

⁴¹ Mary S. Morgan and Tarja Knuuttila, "Models and Modelling in Economics," in *Handbook of the Philosophy of Science Volume 13 Philosophy of Economics*, ed. Uskali Mäki (Elsevier, 2012), 49.

⁴² Porter, "Culture of Quantification," 168.

⁴³ Porter, 168.

vastly different conceptualization of statistics to the one we are familiar with nowadays. Contrary to the contemporary view, which associates statistics with purely methodological and technical standardization, its predominant developer saw it as an educational device. This case highlights the need to carefully assess the seemingly neutral methodology which is often automatically accepted and adopted in the name of increasing the level of scientific sophistication of a given field. That is not to say that economics did not benefit from Pearson's contributions or the association with natural sciences. However, the long-lasting affiliation with moral philosophy and the qualitative nature of a number of the questions asked and answered by economics, makes it an inherently social science, escaping the purely physics-based paradigm.

1.3 Digging deeper

The deliberations above point to the murky status of quantification within economics. On the one hand, it has been adopted to formalize the knowledge of economic phenomena and establish economics as a consistent science with a concrete methodology, i.e. a positive science. On the other hand, the Newtonian paradigm and normative agendas of the scholars who developed economic thought burdened it with a plethora of unrevised assumptions, which became implicitly accepted as true and weaved into the methodological frame of economics. Therefore, it is imperative to explore what the essence of quantification is, and how its use facilitates the adoption of normative beliefs into self-evident truths.

Quantification may be defined as a practice of expressing relevant information in a numerical form as opposed to a semantical one.⁴⁴ It is crucial to highlight that quantification in-itself is a complex process, since, as explained by Centemeri, when quantifying one must first assume that something is indeed measurable (mathematize) and then measure (quantify).⁴⁵ For simplicity's sake, I will use the terms quantification and mathematization interchangeably as they are inevitably linked, have similar connotations and aim at formalizing the reality in which we function. Under the term

⁴⁴ Laura Centemeri, "The Contribution of the Sociology of Quantification to a Discussion of Objectivity in Economics," in *Facts, Values and Objectivity in Economics*, ed. José Castro Caldas and Vítor Neves (Routledge, 2012), 110.

⁴⁵ Centemeri, "Sociology of Quantification" 116.

quantification a range of technical procedures may be subsumed, including mathematical descriptions, simple linear graphs as well as complex statistical models.

It is useful to emphasize that, contrary to what is often claimed, quantification is not a purely technical endeavor. It is also not an epistemically neutral and innocent act. Considering that quantification requires framing reality into a stylized, organized and simplified version, it follows that mathematization bends our perception to fit that frame. Although it may seem that through this process, the quantified objects remain unchanged and become clearer and more explicit, this is not entirely true, thus a degree of caution is advisable. Firstly, deeming something measurable is already an assumption (see the definition above), which transforms the object of inquiry.⁴⁶ This transformation occurs, because the desire to measure and the consequent conviction that something is measurable may already cause the researcher to take a particular view or interpretation of the object of measurement, resulting in a more or less subtle transformation.

Secondly, not only do the objects of quantification undergo a transformation, so does the reality itself. This is because quantification enables new concepts to arise, which in turn influence the economic reality. Porter indicates that unemployment rate and various indexes are notions which were introduced as a result of performed measurement,⁴⁷ while Centemeri adds that these objects had no existence before the establishment of the social convention.⁴⁸ Hence, quantification may also imply invention, and, in that sense, the technique produces the phenomena which are for the first time acknowledged and become perceived as part of reality. Centemeri also highlights the “agreed upon realism” of quantified objects. She argues that they are, by definition, artificial, yet concurrently must be considered real. Otherwise, these objects could not further the forms of coordination necessary for the achievement of social goals.⁴⁹ Simply put, they could not serve their intended purpose, which, like in the case of unemployment, for example, is monitoring and controlling the amount of vocation-less individuals. Hence, although often the quantified objects are part of the constructed economic landscape, their usefulness depends on their embeddedness and reification in the real world.

⁴⁶ Centemeri, 117-118.

⁴⁷ Porter, “Culture of Quantification,” 170.

⁴⁸ Centemeri, “Sociology of Quantification” 116.

⁴⁹ Centemeri, 118.

Bearing in mind the transformative power of quantification, it becomes increasingly problematic to view it as an innocent and purely methodological tool. Some scholars even warn that “the proper objects of enquiry in the social sciences, are not quantifiable without causing serious damage to our understanding.”⁵⁰ I claim that quantification should not, however, be perceived as something harmful. Instead, the point that needs to be made is that quantification is not as innocent as it may seem and is in fact a very powerful tool. As Porter notes, quantification has both virtues and vices.⁵¹ Just because objects of inquiry, such as unemployment, are created through the process of quantification, this itself is not an inherently bad thing. It is crucial to remember though that danger lies in forgetting about the ways in which quantification alters our vision.

Relating back to the problem of over-quantification, depicted at the beginning of this chapter, if quantification can bend and obscure our vision, over-quantification has the capacity to completely blind us. As disturbing as this statement may be, several researchers have pointed towards the danger of number-fixation. For example, Gray poetically states that, “measurement can mesmerize and precise measurement can mesmerize precisely”, highlighting the allure and peril of over-quantification.⁵² One should therefore carefully consider what over-quantification entails.

2. The promised land

The brief account of the historical development of economics and the tendency to quantify economic phenomena has shown that although mainstream economic thought is currently viewed as inherently mathematical, it has become so through a particular progression of thought and practice. I have also shown that this association is not innocent, nor does it deliver the highly regarded value-free results. The previous chapter exposed that the historical processes and the nature of quantification itself burden economics with epistemological frames, assumptions and

⁵⁰ Wolfgang Drechsler and Lukas Fuchs, “Mind the Consequences,” in *The Politics of Modelling*, ed. Andrea Saltelli and Monica Di Fiore (Oxford University Press Oxford, 2023), 84, <https://doi.org/10.1093/oso/9780198872412.003.0006>.

⁵¹ Porter, *Trust in Numbers*, 86.

⁵² Jack Gray, “Overquantification,” *Financial Analysts Journal* 53, no. 6 (1997): 7, <https://doi.org/10.2307/4480035>.

normative beliefs which tend to be implicitly accepted as neutral. Since the supposed neutrality lies in the center of the affinity to quantification, it is crucial to analyze what this appeal to neutrality actually entails and what epistemological promises it renders. Therefore, this chapter is meant to analyze what arguments are put forward when discussing the neutrality of economic discourse, as well as investigate what other beliefs this neutrality underpins and promotes. This will open the possibility for problematizing current practices and assessing the dangers these epistemic beliefs entail.

2.1 The nature of neutrality

As described in chapter 2, the field of economics has been developed by thinkers with diverse backgrounds, some more and some less inclined towards quantitative research methods, all of whom borrowed, perpetuated, built on, and drew upon thoughts and ideals of one another. Hence, this amalgamation of thought was not by any means ‘natural’, in the sense that it was not by some divine providence, chance or the nature of the phenomena assessed that economics has become so closely connected with quantitative methodology. The particular, mathematical manner in which economics is typically perceived is rather the effect of an evolution, which has yielded commendable, although not completely perfect, results. It is justified to hold that the prevalent mode of economic thinking is a result of beliefs, values and ideals of those early economists and the subsequent continuation of the created theories by later scholars. The methodologies chosen and the ones discarded testify to the values we further, even though the normative (and subjective) convictions often become implicitly assumed and thus evade scrutiny.⁵³

Some may still argue that although historically the drive towards quantification might have had some less-than-objective elements, it has been necessitated by the fact that economics deals with prices and quantities, which are inherently mathematical entities.⁵⁴ Consequently, quantification is deemed as natural and, by extension, a neutral process. The argument is consistent, because anything that occurs naturally is assumed not to have been forced or influenced and, in this sense,

⁵³ Mirowski, “Efficacy of Mathematics,” 171,191.

⁵⁴ Mirowski, 162.

must be neutral. Nevertheless, it cannot be accepted as entirely true that prices and quantities imply neutrality. Firstly, historically speaking, exchanges have not always been recorded in an inherently quantified way. After all, before any currency existed commerce was conducted on a barter basis. Later, as Mirowski mentions, in the medieval times, merchants did not keep track of their transactions to estimate profit or loss in a way we imagine it today. The evidence suggests that the money, prices or commodity units are not necessarily quantitative in some ontological sense but rather are contingent on social practices.⁵⁵ Moreover, one should not lose sight of the fact that economics deals with human behavior and therefore is innately embedded in the human experience. It is not difficult to admit that people are not mathematical, and personhood cannot be reduced to an equation, which stands in direct contradiction to the claim that economics as a science must be primarily quantitative.

This relates to a broader discussion regarding the epistemological assumptions about economics in general. Within the Newtonian paradigm, the economy is conceived as being independently ‘out-there’, subject to observation, whereas it would seem more justified to view it as socially determined and structured. In fact, it has been argued that quantitative practices associated with natural sciences and adopted in economics are a matter of beliefs and epistemological assumptions introduced in Early Modern Europe.⁵⁶ If one accepts that economics is not in a pristine, ontological sense necessarily mathematical and that it does not ‘naturally’ exhibit stable mathematical properties, it follows that the quantitative practices are a result of normative assumptions and preferences. Accepting the above should not be challenging, especially considering the arguments made in previous chapters on how economics developed as a science and on the transformative qualities of quantification. Thus, one can question what economists truly ‘discover’, if the economic world is socially embedded and not independently ‘out-there’. Careful consideration may point to the conclusion that rather than discovering the economy, one creates it – economy can be seen as performative, and we are a part of the performance.

⁵⁵ Mirowski, 164.

⁵⁶ Mirowski, 164.

Another point brought forward in defense of supposed neutrality of economic discourse is the belief that mathematics is a language of the economy.⁵⁷ If economics is inherently mathematical, it should be communicated in a mathematical form and even if one is inclined to believe the contrary, economics should still be formalized in this manner. The presupposition underlying this claim is that quantitative descriptions are superior or arguably the only proper way of describing economic phenomena. It is often emphasized that because of its rigidity and structure, mathematical formalization is free of metaphors or allusions rendering a transparent, value free representation of the economy.⁵⁸ Yet, this perception fails to account for the creative uses in which mathematics can translate and obscure biases. In his book *How to Lie with Statistics* Darrell Huff discusses how choosing the right average, sample selection, visual representation, graph specification, accounting only for mathematical relevance while disregarding the scientific one, among other practices, can change the reception of the information presented.⁵⁹ Although these may be examples of academic dishonesty, they showcase how quantitative formalization is not a sole guarantor of a neutral stance. Moreover, as Mirowski notes, and what I have been attempting to show in the previous chapter, “mathematics bears implicit content, oftentimes freighted in below the waterline of consciousness.”⁶⁰ It therefore influences both the perception of the phenomena described in mathematical terms and the standing of economics as an academic discipline.

Alternatively, Erica Thompson showcases the artful quality of computational presentation by comparing models to caricatures. She highlights that they emphasize some feature(s) of reality while neglecting others, just as a caricature, or a photo does.⁶¹ According to her, such an outlook on modelling aids in recognizing how it can create, communicate and share insights, while keeping in mind the stereotyping that comes with the practice. The creative shaping of phenomena occurring while creating any type of model, be it mathematical, statistical or a physical one, includes various value judgements that allow for a simplified, perhaps superficial presentation of the modelled reality. Hence, even if one holds that mathematics is merely a language, the intricacies of its semantics cannot be neglected. Crafting a sentence in any language takes skill,

⁵⁷ Mirowski, 165.

⁵⁸ Mirowski, 166.

⁵⁹ Darrell Huff, *How to Lie with Statistics* (Penguin Books, 1991).

⁶⁰ Mirowski, “Efficacy of Mathematics,” 191.

⁶¹ Thompson, *Model Land*, 35.

creativity, and attention to the meanings attributed to every structural element, and this also applies to mathematics.

2.2. Perceived objectivity

As explained in the previous sections, the methodology imported from physics was meant to solidify economics as a ‘proper’ or ‘hard’ science. This implies a positive as opposed to the normative conceptualization of economics, emphasizing objective rather than subjective inquiries and answers. Objectivity is thus, much like neutrality, painted as an important, defining characteristic that economics should be based on. It is therefore imperative to consider its exact meaning.

Objectivity may take different meanings depending on the applicable definition. According to the most common one, which can be found in the *Cambridge Dictionary*, it is “the fact of being based on facts and not influenced by personal beliefs or feelings.”⁶² This closely relates to the adoption of the so called ‘view from nowhere’, which encompasses the ideal of a disinterested, impersonal, value free and objective discipline. In other words, the baseline definition of objectivity is linked to the adoption of the ‘view from nowhere’ encompassing the value-free ideal of science. As Thompson writes, in this framework, science is aimed at “the discovery of empirical fact that can be determined with reference to external reality, and the scientist is only an impartial medium for that discovery.”⁶³ Notably, as Porter suggests, objectivity as impartiality is often confused with objectivity as truth.⁶⁴

However, this standard conceptualization of objectivity and the ‘view from nowhere,’ although epistemologically alluring, may not deliver a proper outlook on a social science such as economics. A question that follows is whether such an ideal is even attainable. As the historical analysis from the previous chapter exposed, the methodological developments incorporated beliefs about reality

⁶² *Cambridge Dictionary*, “objectivity,” accessed June 6, 2025, <https://dictionary.cambridge.org/dictionary/english/objectivity>.

⁶³ Thompson, *Model Land*, 215.

⁶⁴ Porter, *Trust in Numbers*, 74.

and values of the theoreticians. While not always condemnable, the personal goals of scientists, like in the case of Pearson, who envisioned a moral role for statistics, influence the discourse which is then painted as neutral. Although it may be uncomfortable to admit, even the most technical methods have an element of conventionality.

Taking Porter's example of statistical inference one can notice some arbitrariness of a seemingly concrete quantitative methodology. The set standard of 0.05 confidence level to determine significance of results, so prevalent in contemporary economic writings, is mostly conventional despite rarely being seen as such.⁶⁵ There is an inherent judgement passed, or at least accepted, when asserting a result is viable if the chance of it being wrong is less than 5%. Moreover, as Thompson writes, mathematical models cannot reach the naïve standard of objectivity as they implicitly include personal opinions about relative importance of the factors included and those omitted.⁶⁶ For example, in economic models, the choice of an applicable discount rate, in simple terms, indicates how much one values the present compared to the future and possibly exposes their degree of risk aversion. It then can be questioned whether one is able to arrive at a truly objective outcome when the presuppositions are often inherently subjective. Porter also rejects the claim that it is possible to fully eliminate elements of expert judgement and states that it may be "worse than futile" to believe so.⁶⁷

Another question that arises is whether such ideal of objectivity is desirable in the first place or is it a misguided ambition. Even if the 'view from nowhere' was attainable, is this an ideal economists should further? There are debates whether objectivity, understood as complete impartiality and value blindness, is a desirable standard for economics, and some, like John Davis, advocate for a change. He convincingly argues that the 'view from nowhere' creates two false impressions about the economy. Firstly, that what mainstream economic theory addresses is all that there is to be seen. Secondly, that the economy is an independent, discoverable system which appears to be deterministic (recall the Newtonian paradigm). Importantly, these impressions, encouraged by the 'view from nowhere' and the belief in objectivity, have problematic implications. Davis warns that

⁶⁵ Porter, 212.

⁶⁶ Thompson, *Model Land*, 215.

⁶⁷ Porter, *Trust in Numbers*, 216.

they lead to neglecting the robustness of human values and their economic roles, additionally imposing fatalism which prevents perceiving the economy as a construct that can promote socially desirable goals.⁶⁸ He argues that mainstream economics, by reducing human behavior to simple parameters and relationships as well as presuming people are highly predictable, in an attempt to evade indeterminacy, imposes a degree of determinism. This, in turn, allows for assuming that the future will be much like the present and making predictions based on past data.⁶⁹ Such conduct leads to a limited understanding of the economy, failing to address the dynamic and complex nature of economics, as well as our ability to influence it for the society's benefit. Consequently, commitment to objectivity may be undesirable or even harmful, impoverishing rather than elevating economics as a science.

It has also been argued that the meaning of objectivity in science is slightly more nuanced than the one discussed above. Contrary to the baseline definition, Thompson states that objectivity as a benchmark for scientific practice means conformity to the current set of social standards.⁷⁰ Centemeri also seems to agree with this point, by explaining that objectivity entails subordination to publicly shared standards of relating to and judging others and the material environment.⁷¹ She notes that objective knowledge is deemed as such because people rely on it as an object of reference and that object itself depends on institutional factors.⁷² It seems that even if objectivity is commonly understood as separateness from personal beliefs and feelings, in science it rather implies attaining a certain institutionalized standard of inquiry. This points to the conclusion that the objectivity benchmark, rather than being a testament to scientific purity encapsulated by the 'view from nowhere' approach, is a tool that serves to reinforce trust in socially embedded, scientific practices. In line with the above one could argue that economic inquiry can be objective in the sense of conformity with a current, scientific practice but not in the sense of purity from personal values and beliefs or professional opinion. Hence the dictionary understanding of objectivity is insufficient or even naïve.

⁶⁸ John B. Davis, "Objectivity in Economics and the Problem of the Individual," *Journal of Economic Methodology* 30, no. 4 (March 1, 2023): 277, <https://doi.org/10.1080/1350178x.2023.2181374>.

⁶⁹ Davis, "Problem of the Individual," 280-281.

⁷⁰ Thompson, *Model Land*, 36.

⁷¹ Centemeri, "Sociology of Quantification" 111-112.

⁷² Centemeri, 123.

If one considers the dictionary definition of objectivity and the related ‘view from nowhere’ as neither achievable nor desirable and adopts a more nuanced conceptualization of what objectivity means in science, it is natural to seek a better substitute. In response to the ‘view from nowhere’ Davis proposes adopting a ‘view from somewhere’, by acknowledging the positing of a scientist within their research and striving for a more open practice of economics. According to him, emphasis should be placed on facilitating a more conscious and transparent disclosure of underlying assumptions and transformative steps inherent in the scientific process.⁷³ Another alternative to this objectivity ideal may be that of ‘strong objectivity’, outlined by Thompson, which emerges from diversity and collaboration. She describes Sandra Harding’s system which advocates for approaching scientific questions from different standpoints and embracing alternative models produced by a variety of experts.⁷⁴ Both solutions are ways to escape the current paradigm and acknowledge conventionality and value-ladenness, without slipping into absolute relativism and making the economics seem like a needless enterprise. Being aware that alternatives do exist, it is crucial to acknowledge that the quest for objectivity is *an* ideal furthered by the scientific community, even though it is not the *only* ideal that could be adopted.

2.3. Fictitious certainty

Since economic discourse is believed to be objective in the naïve sense, even if, as shown above, it may not actually be so, it also promises to deliver certainty in its outcomes. According to the *Cambridge Dictionary*, certainty is defined as “the state of being completely confident or having no doubt about something” or “the sure knowledge that something is true.”⁷⁵ Certainty may thus be interpreted as accuracy in correspondence to the real world and, in the context of economic modelling, this suggests trustworthiness of predictions. From the prior sections a pattern emerges, which explicates faith in certainty within the field. Because economics is presumed to be naturally quantitative, one can accurately measure and describe it in a law like manner and thus make predictions and prescriptions for future economic decisions. If one manages to purify the study to

⁷³ Davis, “Problem of the Individual,” 281-182.

⁷⁴ Thompson, *Model Land*, 217.

⁷⁵ *Cambridge Dictionary*, “certainty,” accessed June 14, 2025, <https://dictionary.cambridge.org/dictionary/english/certainty>.

the objective ideal, escaping interests and beliefs, then the result avoids bias, in turn making it certain. Some problems emerge when considering this thought progression.

Certainty takes its rhetorical appeal from the longing for analytical clarity, which cannot be guaranteed by qualitative analyses as much as it can by quantitative ones.⁷⁶ It is assumed to be attainable also because of the atemporal nature of mathematical analyses. Within the Newtonian paradigm, the belief in stable, simple, universal economic laws that wait to be discovered, make the patterns, causal chains and outcomes seem timeless. However, it is doubtful that all economic behavior remains unchangeable, hence the certainty derived from such discoveries is only fictitious or applicable in a very specific and narrow timeframe. As Weisskopf accurately points out “the human situation was and is always one of uncertainty and indeterminacy as far as the future is concerned; what changes are the philosophy, and the methods used to assuage the resulting anxiety.”⁷⁷

Still, some may argue that the problem of uncertainty or inaccuracy in the outcomes can be solved with more refined mathematical tools and techniques. Although we err in making some predictions and inferences, technological advancements, can augment understanding, modelling and mapping economic systems. It is, however, unlikely that mathematical finesse will be able to rescue us from uncertainty. As Puy and Saltelli describe, computational complexity comes with considerable drawbacks. They claim that increasingly detailed mathematical models may produce less rather than more certain estimates. This phenomenon is referred to as the ‘uncertainty cascade’, describing a situation where “uncertainties add up and expand with model complexification.”⁷⁸ Stated simply, uncertainty increases, because with each additional parameter, the number of uncertain parameters which create the model’s uncertainty space, raises exponentially.⁷⁹ Additionally, “highly detailed models tend to be so computationally demanding to run that the

⁷⁶ Shawn J. Bayern, “Against Certainty,” *Hofstra Law Review* 41, no. 1 (2012): 53, <https://scholarlycommons.law.hofstra.edu/hlr/vol41/iss1/4>.

⁷⁷ Weisskopf, “Method Is the Ideology,” 879.

⁷⁸ Arnald Puy and Andrea Saltelli, “Mind the Hubris: Complexity Can Misfire,” in *The Politics of Modelling: Numbers between Science and Policy*, ed. Andrea Saltelli and Monica Di Fiore (Oxford University Press, 2023), 54, <https://doi.org/10.1093/oso/9780198872412.003.0004>.

⁷⁹ For a detailed explanation see Puy and Saltelli, “Mind the Hubris,” 54-58.

exploration of their uncertainty space often becomes unaffordable” and if the uncertainty space is not sufficiently explored, the model estimates may be only spuriously accurate.⁸⁰

Moreover, the conviction that computational complexity and mathematical sophistication can solve problems with certainty has another shortcoming. It addresses the epistemic uncertainty yet neglects the significance of the aleatoric one. As Kiureghian and Ditlevsen explain, uncertainty can be divided into these two categories: the epistemic one, “presumed as being caused by lack of knowledge (or data),” and the aleatoric one, considered “to be the intrinsic randomness of a phenomenon.”⁸¹ Whereas the former may be, in theory, aided by increasing technical proficiency, although as argued above this may not necessarily be the case, the latter is difficult, if not impossible to mitigate. In effect it is imperative to be realistic about the expectations of the modelled predictions and clearly delineate the uncertainties unaccounted for.

The deliberations above point to the conclusion that the so highly desired certainty may not even be attainable in the first place. The question that should be asked here is whether the insistence on certainty is justified. Being so difficult, if not impossible, to attain, given its aleatoric dimension and even considering state-of-the-art technology, placing so much emphasis on certainty may be a wrong course to take. It is therefore useful to rethink if it should be paramount. To this end, Thompson argues that a healthy range of uncertainty may help us combat overconfidence in our predictions.⁸² Some certainty is undoubtedly desired, however one should be cautious not to overstate its importance and avoid “the self-assured arrogance that comes with a lack of attention to these epistemological issues.”⁸³

⁸⁰ Puy and Saltelli, “Mind the Hubris,” 56.

⁸¹ Armen Der Kiureghian and Ove Ditlevsen, “Aleatory or Epistemic? Does It Matter?,” *Structural Safety* 31, no. 2 (March 2009): 106, <https://doi.org/10.1016/j.strusafe.2008.06.020>.

⁸² Thompson, *Model Land*, 68.

⁸³ Puy and Saltelli, “Mind the Hubris,” 54.

3. The fall from grace

Having discussed the historical development of over-quantification and the epistemological convictions connected with it, a useful exercise is to consider what these convictions may result in by dissecting the related, problematic practices within economics. Believing that economics is naturally mathematical and has a neutral methodology, which delivers objective and certain results, comes with a plethora of implications. The phenomenon of over-quantification has unsettling consequences for the study of economics, which are often underestimated when weighed against the benefits of its mathematical virtues. Hence, the following sections highlight the dangers of abusing quantitative methodology.

3.1 Oversimplification and mindset constraints

As discussed in the first chapter, quantification requires simplification and modification of reality for the sake of tractability in terms of mathematical expression. I have argued that quantification bends perception, and over-quantification may even blind the incautious user. Thus, with over-quantification, one runs the risk of oversimplifying a nuanced reality. As Porter writes, the benefit that quantification may yield, namely that of eradicating bias, interestedness and arbitrariness, if achieved, comes at a considerable cost of forsaken subtlety and depth.⁸⁴ For example, as commonly done, unemployment rate is measured based on the number of people officially registered as unemployed or alternatively based on the data gathered from Labor Force Surveys.⁸⁵ Although it may be an accepted way of doing so, in this case quantification fails to account for the people who are underemployed, lack stable income and take seasonal jobs or work on the black market. In his work, Porter adds that there are no limits to what can be counted and oftentimes attempting to quantify parts of reality to answer large questions, excludes a profound and multifaceted analysis.⁸⁶ If the set standard for inquiry is the naively objective and mathematical one, the credibility of other

⁸⁴ Porter, *Trust in Numbers*, 86.

⁸⁵ Karolina Dawidziuk, "Jak Liczymy Bezrobocie?," *Główny Urząd Statystyczny*, February 28, 2018, <https://stat.gov.pl/obszary-tematyczne/rynek-pracy/zasady-metodyczne-rocznik-pracy/jak-liczymy-bezrobocie,2,1.html>.

⁸⁶ Porter, *Trust in Numbers*, 86.

types of assessments decreases. Porter also states that if subtlety and depth are erased from discourse in favor of simplicity and standardization, they may be lost from the world in general.⁸⁷

Part of what contributes to the loss of nuance is something that Muller calls the ‘metric fixation’. The term perfectly describes the tendency to over-rely on mathematical methodology and relates to persistent beliefs that numerical indicators can and should replace judgement gained by personal experience as well as to the assumption that making metrics available increases transparency and accountability.⁸⁸ He describes several problems, which metric fixation entails, such as measuring only what is easiest even when the desired answer is complex or degrading information quality in the strife to standardize it.⁸⁹ It has also been argued that increased attention to mathematics or one’s mathematical background plays an essential role in the researcher’s output. As Debreu notes, commitment to a quantitative formalism determines the types of questions asked and answered in economics. This is not without danger, since if the focus is placed solely on the easily tractable phenomena, other ones may become considered as secondary or even marginalized, even though they may not be factually less influential or relevant.⁹⁰ The above highlights that even though we may be convinced a model broadens our understanding of the world, it may in fact limit it. Therefore “it’s important to consider the ways in which the tools and materials to hand might be constraining to [the] imagination.”⁹¹

3.2 Enshrouded biases

Having discussed that quantification is seen as a pathway to objectivity and clarity, I have also mentioned that it can serve to obscure the normative assumptions, and personal or structural biases embedded within the processes of mathematization and measurement. It is important to remember that decisions regarding what and how to measure, the definition of variables and constants, or the

⁸⁷ Porter, 86.

⁸⁸ Jerry Z Muller, *The Tyranny of Metrics* (Princeton: Princeton University Press, 2019), 10, <https://www.jstor.org/stable/j.ctvc7743t>.

⁸⁹ Muller, *Tyranny of Metrics*, 23-24.

⁹⁰ Gerard Debreu, “The Mathematization of Economic Theory,” *The American Economic Review* 81, no. 1 (1991): 5, <http://www.jstor.com/stable/2006785>.

⁹¹ Thompson, *Model Land*, 29.

choice of the applicable model are subject to the opinion of the scientist or at least encompass the existing theoretical or cultural norms. An example of this is using Gross Domestic Product (GDP) as a measure of the society's well-being, which requires assuming that the monetary value of economic output of the country is an appropriate indicator of its citizens' welfare. Another example is the previously mentioned discount rate, which encodes the perceived value of future outcomes. These decisions may reflect dominant beliefs, perceived as neutral, while marginalizing alternative ones. Additionally, biased sampling, incomplete data, inappropriate proxies and other unchecked and seemingly innocent informational omissions put into the model encode the existing partialities.

Moreover, as described in the previous section, the process of quantification often strips away context and complexity. For example, equating utility with money in a model may be a way to simplify and tractate policy implications; however, it cannot account for the intricacies of the related political responses, or people's emotions and satisfaction levels. Although, quantifying utility delivers a simple measure, judgement on how much utility is assigned to each outcome and stakeholder still has to be made, which often is forgotten when inputting the number into a model. This can create a false sense of objectivity, further reinforcing the confidence in a 'value-free' practice.

Consequently, it is imperative to openly state the assumptions made while conducting research and carefully assess whether a number is truly objective. What is also important to consider is the background of researchers, since it contributes to the shape the academic output. Most research is done from, as Thompson puts it, a WEIRD standpoint, i.e. Western, Educated, Industrial, Rich, Developed, which implies the models and their interpretations are also going to include a WEIRD lens, whether consciously or subconsciously.⁹² Therefore, an emphasis should be placed on avoiding model fixation and creating intersectional and diverse study groups.

⁹² Thompson, 10.

3.3 Accountability gap

The earlier discussed beliefs about objectivity and neutrality have yet another string attached – loss of accountability. “The notion of ‘following the science’ becomes a screen behind which both decision-makers and scientists can hide.”⁹³ Since mathematical formalism requires a certain level of training and expertise, especially in an age of rapidly growing computational complexity, some criticism is neatly evaded. Previously cited Debreu highlights that the esoteric character of mathematized economic theory contributed to its spread.⁹⁴ If only the technically savvy with proven credentials can comment on the developments and discoveries, the pool of people available to conduct the appropriate checks and balances becomes very limited. One is then left to accept the technical expertise of those familiar with the code, which also means adopting their values.⁹⁵ The mathematical hubris is so problematic because it deems qualitative criticisms as less worthy, because they fail to conform to the standardized quantitative practices. This also relates to considerations in the previous section, as the lack of diverse criticism furthers current thought patterns and hinders innovation and robustness. Moreover, technical proficiency may also act as a smoke screen to detract from engaging in any investigation. As Mirowski cites, dressing theories in impressive formulations somehow makes them appear more serious, even though in reality they may be scientifically absurd.⁹⁶ Porter also notices that “subjectivity creates responsibility. Impersonal rules can be almost as innocent as nature itself.”⁹⁷ This point directly relates to the discussion on neutrality and objectivity of economic discourse in the previous chapter.

Apart from the technical constraints, what also allows for waving accountability is the fact that mathematical models may often be unattributable to one person. Thompson writes that they take a semi-autonomous form and become distinct from the modeler’s opinion.⁹⁸ This creates issues, as the modeler creates or modifies the model, into which they consciously or not embed their beliefs. Moreover, the model then informs the expert and others about the reality and helps produce its

⁹³ Thompson, 11.

⁹⁴ Debreu, “Mathematization,” 6.

⁹⁵ Debreu, 6.

⁹⁶ Mirowski, “Efficacy of Mathematics,” 160.

⁹⁷ Porter, *Trust in Numbers*, 196.

⁹⁸ Thompson, *Model Land*, 104.

interpretation. Therefore, Thompson argues, the model and the modeler should be considered as a single system to be evaluated in conjunction.⁹⁹ Additionally, the air of objectivity that mathematical expression provides, not only facilitates hiding personal biases, as discussed in the previous section, but also provides an undisputable excuse. If the number ‘speaks for itself’ in a supposedly objective manner, there is no need to claim ownership of the given recommendation or opinion. In the case of the Black-Scholes model presented in the introduction, this lack of ownership is clearly depicted. The model came to serve as an industry standard and was applied in cases where the assumptions didn’t hold. As described earlier, this ultimately contributed to the fall of the LTCM hedge fund and arguably to the 2008 financial crisis.

Conclusions

This thesis has examined the phenomenon of over-quantification within economics, starting with the presentation of the status-quo. By historically tracing the rise of over-quantification, an image of a diverse and normatively laden discipline of economic thought emerged, which diverges from the view of a rigid, objective and mathematical science often favored today. The analysis of the development of economics has also highlighted the prevalent Newtonian paradigm, which arguably shapes economics to this day. Moreover, the discussion on the often missed transformative aspects of quantification, both in theory and practice, has indicated that the drive towards more mathematical formalism has profound consequences.

The subsequent sections explored the supposed neutrality of economic discourse as well as the allure of over-quantification. Yet, as I have argued in this thesis, the promises of objectivity and certainty attributed to the quantitative methodology are more illusory upon practical application than may be expected. In fact, it seems that the adoption of ever more complex mathematical models and formalisms in economics has not resulted in a value-free science. On the contrary, by supporting appeals to objectivity, the normative assumptions inherent in the methodological choices have masked the contingencies of our current practices. Additionally, the belief in the

⁹⁹ Thompson, 99.

certainty of modelled outcomes has contributed to faith in computational complexity and (potential) infallibility of quantitative methodology. It is imperative to retain a degree of caution and be realistic about the epistemic possibilities of economic enquiry.

In the last chapter, the considerable implications of these epistemic beliefs are discussed. The reliance on mathematical formulation may lead to the oversimplification of complex, social phenomena. It may cause the disregard for the non-easily quantifiable parameters and ultimately narrow the perspective on more nuanced problems. Moreover, the belief in objective and neutral economic discourse creates a risk of overlooking and perpetuating existing biases within the field. Lastly, because of the complexity of the models and the lack of their clear ownership, an accountability gap arises. When models fail, their creators often remain absolved from the blame and the decision makers who relied on them proclaim the numbers were at fault. All these practices are problematic for the application of economics for social benefit and highlight the necessity of reevaluating the status quo.

In conclusion, the over-quantification in economics has not merely altered the methodological tools in use, but also transformed the discipline and its epistemological foundations. Since economics is directly concerned with human behavior and the wellbeing of the society, it needs to also serve societal goals. If the practice of economics seeks to stay true to its origins and real-world applicability, it must recognize its broad normative dimension and admit that mathematical formalism will not absolve it of the moral responsibility of choosing and disclosing the values it furthers. It needs to be emphasized that although the phenomenon of quantification has benefited economics, in the current, often reflectionless and unwarranted form, it becomes dangerous. We should therefore strive for a more nuanced, open and qualitatively rich study which acknowledges its limitations. After all, are not true scientists only those who demonstrate humility towards the limitations of their findings?

Bibliography

- Allington, Nigel F. B., John S. L. McCombie, and Maureen Pike. "Lessons Not Learned: From the Collapse of Long-Term Capital Management to the Subprime Crisis." *Journal of Post Keynesian Economics* 34, no. 4 (July 1, 2012): 555–82. <https://doi.org/10.2753/pke0160-3477340401>.
- Bayern, Shawn J. "Against Certainty." *Hofstra Law Review* 41, no. 1 (2012): 53–90. <https://scholarlycommons.law.hofstra.edu/hlr/vol41/iss1/4>.
- Bergman, Cynthia. "EPA Announces First-Ever Rule to Reduce Mercury Emissions from Power Plants." *United States Environmental Protection Agency*, March 15, 2005. https://www.epa.gov/archive/epapages/newsroom_archive/newsreleases/91ab7266e65751b985256fc50067d9b0.html.
- Black, Fischer, and Myron Scholes. "The Pricing of Options and Corporate Liabilities." *Journal of Political Economy* 81, no. 3 (May 1973): 637–54. <https://doi.org/10.1086/260062>.
- Boulding, Kenneth E. "Economics as a Moral Science." *The American Economic Review* 59, no. 1 (1969): 1–12. <https://www.jstor.org/stable/1811088>.
- Bristow, William. "Enlightenment." In *Stanford Encyclopedia of Philosophy*. Stanford University, 1997–. Article published August 20, 2010; last modified August 27, 2017. <https://plato.stanford.edu/archives/fall2023/entries/enlightenment/>.
- Campanario, M. L., and J. A. Lara. "Lessons Learned from the Misuse of Mathematical Models: The 2008 Financial Crisis." In *AIP Conference Proceedings*, 1618:759–62. AIP Publishing, 2014. <https://doi.org/10.1063/1.4897843>.
- Carey, Maeve P. "Cost-Benefit Analysis in Federal Agency Rulemaking." *Congressional Research Service*, November 28, 2024. <https://www.congress.gov/crs-product/IF12058>.
- Caruso, Denise. "The Myth of Cost-Benefit Analysis." *Strategy+Business*, February 26, 2008. <https://www.strategy-business.com/article/08103>.
- Centemeri, Laura. "The Contribution of the Sociology of Quantification to a Discussion of Objectivity in Economics." In *Facts, Values and Objectivity in Economics*, edited by José Castro Caldas and Vítor Neves, 110–25. Routledge, 2012.
- Davis, John B. "Objectivity in Economics and the Problem of the Individual." *Journal of Economic Methodology* 30, no. 4 (March 1, 2023): 276–89. <https://doi.org/10.1080/1350178x.2023.2181374>.
- Dawidziuk, Karolina. "Jak Liczymy Bezrobocie?" *Główny Urząd Statystyczny*, February 28, 2018. <https://stat.gov.pl/obszary-tematyczne/rynek-pracy/zasady-metodyczne-rocznik-pracy/jak-liczymy-bezrobocie,2,1.html>.

- Debreu, Gerard. "The Mathematization of Economic Theory." *The American Economic Review* 81, no. 1 (1991): 1–7. <http://www.jstor.com/stable/2006785>.
- Drechsler, Wolfgang, and Lukas Fuchs. "Mind the Consequences." In *The Politics of Modelling*, edited by Andrea Saltelli and Monica Di Fiore, 83–98. Oxford University Press Oxford, 2023. <https://doi.org/10.1093/oso/9780198872412.003.0006>.
- Gray, Jack. "Overquantification." *Financial Analysts Journal* 53, no. 6 (1997): 5–12. <https://doi.org/10.2307/4480035>.
- Harford, Tim. "Black-Scholes: The Maths Formula Linked to the Financial Crash." *BBC News*, April 28, 2012. <https://www.bbc.com/news/magazine-17866646>.
- Huff, Darrell. *How to Lie with Statistics*. Penguin Books, 1991.
- Kiureghian, Armen Der, and Ove Ditlevsen. "Aleatory or Epistemic? Does It Matter?" *Structural Safety* 31, no. 2 (March 2009): 105–12. <https://doi.org/10.1016/j.strusafe.2008.06.020>.
- Mirowski, Philip. "The Unreasonable Efficacy of Mathematics in Modern Economics." In *Handbook of the Philosophy of Science Volume 13 Philosophy of Economics*, edited by Uskali Mäki, 159–97. Elsevier, 2012.
- . "The When, the How and the Why of Mathematical Expression in the History of Economic Analysis." *Journal of Economic Perspectives* 5, no. 1 (February 1, 1991): 145–57. <https://doi.org/10.1257/jep.5.1.145>.
- Montes, Leonidas. "Adam Smith: Real Newtonian." In *A History of Scottish Economic Thought*, edited by Alexander Dow and Sheila Dow, 102–22. Routledge, 2006. <https://doi.org/10.4324/9780203486238>.
- Morgan, Mary S., and Tarja Knuuttila. "Models and Modelling in Economics." In *Handbook of the Philosophy of Science Volume 13 Philosophy of Economics*, edited by Uskali Mäki, 49–87. Elsevier, 2012.
- Muller, Jerry Z. *The Tyranny of Metrics*. Princeton: Princeton University Press, 2019. <https://www.jstor.org/stable/j.ctvc7743t>.
- Porter, Theodore M. "The Culture of Quantification and the History of Public Reason." *Journal of the History of Economic Thought* 26, no. 2 (June 2004): 165–77. <https://doi.org/10.1080/1042771042000219019>.
- . *Trust in Numbers : The Pursuit of Objectivity in Science and Public Life*. Princeton University Press, 1995.
- Puy, Arnald, and Andrea Saltelli. "Mind the Hubris: Complexity Can Misfire." In *The Politics of Modelling: Numbers between Science and Policy*, edited by Andrea Saltelli and Monica Di Fiore, 51–68. Oxford University Press, 2023. <https://doi.org/10.1093/oso/9780198872412.003.0004>.

- Spengler, Joseph J. "On the Progress of Quantification in Economics." *Isis* 52, no. 2 (June 1961): 258–76. <https://doi.org/10.1086/349472>.
- Stewart, Ian. "The Mathematical Equation That Caused the Banks to Crash." *The Guardian*, February 12, 2012. <https://www.theguardian.com/science/2012/feb/12/black-scholes-equation-credit-crunch>.
- Sunstein, Cass R. "The Limits of Quantification." *California Law Review* 102, no. 6 (December 2014): 1369–1422. <https://heinonline.org/HOL/P?h=hein.journals/calr102&i=1421>.
- Thompson, Erica. *Escape from Model Land*. John Murray Press, 2023.
- Vogl, Joseph. "The Sovereignty Effect: Markets and Power in the Economic Regime." *Qui Parle* 23, no. 1 (2014): 125–55. <https://doi.org/10.5250/quiparle.23.1.0125>.
- Weisskopf, Walter A. "The Method Is the Ideology: From a Newtonian to a Heisenbergian Paradigm in Economics." *Journal of Economic Issues* 13, no. 4 (December 1979): 869–84. <https://doi.org/10.1080/00213624.1979.11503709>.