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Law Talk v. Science Talk: The Languages of Law and Science in WTO Proceedings

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LAW TALK V. SCIENCE TALK: THE LANGUAGES OF LAW AND SCIENCE IN WTO PROCEEDINGS

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INTRODUCTION

In the process of creating the legal system underpinning international trade in the aftermath of World War II, the prevailing idea was a continuing liberalization of trade. This in turn meant a closer integration of domestic economies.¹ One way to achieve these ends was what the Preamble to the 1947 General Agreement on Tariffs and Trade (“GATT”) terms the process of “entering into reciprocal and mutually advantageous arrangements directed to the substantial reduction of tariffs and other barriers to trade.”² While the original GATT regime contained rules that allowed for the justification of trade barriers under particular circumstances, in Article XX of the GATT, the increase in international trade³ prompted a number of governments to create barriers other than tariffs or quotas to protect the well-being of their populations, mostly from health hazards or on environmental grounds. These new measures coincided with an increased awareness of the risks that certain products or production methods posed to human life or well-

1. For a variety of narratives, see Thomas J. Dillon, *The World Trade Organization: A New Legal Order for World Trade?*, 16 MICH. J. INT’L L. 349, 351–52 (1995); Joost Pauwelyn, *The Transformation of World Trade*, 104 MICH. L. REV. 1, 12–13 (2005); Daniel Kalderimis, *Problems of WTO Harmonization and the Virtues of Shields over Swords*, 13 MINN. J. GLOBAL TRADE 305, 306–07 (2004); ROBERT E. HUDEC, *THE GATT LEGAL SYSTEM AND WORLD TRADE DIPLOMACY* 23 (Butterworth 2d ed., 1990) (1975); JOHN H. JACKSON, *WORLD TRADE AND THE LAW OF GATT* 2–3 (Bobbs-Merrill 1969).

2. General Agreement on Tariffs and Trade pmbl., Oct. 30, 1947, 61 Stat. A-11, 55 U.N.T.S. 194 [hereinafter GATT].

3. RAYMOND J. AHEARN & IAN F. FERGUSSON, CONG. RESEARCH SERV., R41291, *WORLD TRADE ORGANIZATION (WTO): ISSUES IN THE DEBATE ON CONTINUED U.S. PARTICIPATION* 3 (2010).

being,⁴ therefore elevating the question of risk regulation to a higher level of importance.

Depending on one's point of view, these measures were either instituted for legitimate reasons, that is for the protection of human health or the environment, or they were considered to be a second-generation barrier to legitimate international trade.⁵ Thus, domestic regulation, starting in the 1960s, became an ever-more important tool for domestic decision-makers. Over time, regulation took on a more prominent role than the exact tariff placed on a particular product in international negotiations. At the same time, influential writings from legal scholars and sociologists started to appear popularizing the concept of "risk."⁶ It was not until the Uruguay Round, however, that negotiators finally came to an agreement on rules that fleshed out the justifications laid down in the GATT in more detail with respect to human, animal, or plant life or health,⁷

4. Note however that the public's perception of risks and the scientific evidence for risk may substantially diverge. *See, e.g.*, Leslie Roberts, *Counting on Science at EPA*, 249 *SCIENCE* 616, 616 (1990). For an earlier article providing similar results across a select number of societal subgroups, which shows deviations among them and between scientists, see Paul Slovic, *Perception of Risk*, 236 *SCIENCE* 280, 281 (1987).

5. These differing viewpoints were reflected, for example, in the dispute over US measures to protect marine life. *See* Larry A. DiMatteo et al., *The Doha Declaration and Beyond: Giving a Voice to Non-Trade Concerns within the WTO Trade Regime*, 36 *VAND. J. TRANSNAT'L L.* 95, 99–100 (2003); Warren H. Maruyama, *A New Pillar of the WTO: Sound Science*, 32 *INT'L LAW.* 651, 659–61 (1998). The Preamble of the Agreement on the Application of Sanitary and Phytosanitary Measures ("SPS Agreement") is also indicative in this regard: "Recognizing that developing country Members may encounter special difficulties in complying with the sanitary or phytosanitary measures of importing Members, and as a consequence in access to markets." Agreement on the Application of Sanitary and Phytosanitary Measures pmbl., Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, 1867 U.N.T.S. 493 [hereinafter SPS Agreement]. For further arguments on SPS measures, see generally David G. Victor, *The Sanitary and Phytosanitary Agreement of the World Trade Organization: An Assessment after Five Years*, 32 *N.Y.U. J. INT'L L. & POL.* 865 (2000).

6. Ulrich Beck, in his seminal work *RISIKOGESELLSCHAFT*, coined the term "risk society," and was one of the first authors to begin a larger public discourse about risk. His book appeared in English as *ULRICH BECK, RISK SOCIETY: TOWARDS A NEW MODERNITY* (Mark Ritter trans., Sage Publ'ns 1992) (1986); *see also* NIKLAS LUHMANN, *RISK: A SOCIOLOGICAL THEORY* (Rhodes Barrett trans., 1993).

7. *See* SPS Agreement, *supra* note 5, pmbl.; Elizabeth Fisher, *Beyond the Science/Democracy Dichotomy: The World Trade Organization Sanitary and Phytosanitary Agreement and Administrative Constitutionalism*, in *CONSTITUTIONALISM, MULTILEVEL TRADE GOVERNANCE AND SOCIAL REGULATION* 327, 328–29 (Christian Joerges & Ernst-Ulrich Petersmann eds., 2006).

and international standardization more generally.⁸ The other justifications remained to be fleshed out through the jurisprudence of the previous working parties and the newly-created—and considerably more powerful—dispute settlement mechanism under the Dispute Settlement Understanding (“DSU”).⁹

The Agreement on the Application of Sanitary and Phytosanitary Measures (“SPS Agreement”) has gained particular prominence in this regard since its inception in 1995. This is evident through disputes concerning the permissibility of using growth hormones in raising beef¹⁰ or the use of genetically-modified organisms in the production of food and feed.¹¹ While the SPS Agreement makes specific mention of the role that science plays in ascertaining the existence of risk for the establishment or maintenance of trade restricting measures, such evidence is not unfamiliar to other parts of World Trade Organization (“WTO”) law, especially in the environmental field. While one could be excused for thinking that a science-based approach would lead to a decrease in substantive disputes and a decline in arbitrary decision-making on the domestic level, the track record since 1995 is mixed at best. Questions remain about what constitutes scientific evidence, whether WTO members can rely on a minority scientific opinion or have to adhere to what is considered to be the majority scientific opinion, whether non-scientific factors can play a role, and, importantly, to what extent scientific questions that are not fully researched or where only preliminary scientific evidence exists can be taken into account. WTO dispute settlement organs have therefore been tasked with interpreting terms such as “available scientific evidence” or to determine whether a particular set of

8. Agreement on Technical Barriers to Trade pmbl., Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, 1868 U.N.T.S. 120 [hereinafter TBT Agreement].

9. Understanding on Rules and Procedures Governing the Settlement of Disputes, Apr. 14 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 2, 1869 U.N.T.S. 401 [hereinafter DSU].

10. Panel Report, *EC-Measures Concerning Meat and Meat Products (Hormones)*, WT/DS26/R/USA (Aug. 18, 1997) [hereinafter Panel Report, *EC-Hormones*].

11. Panel Report, *EC-Measures Affecting the Approval and Marketing of Biotech Products*, WT/DS291/R, WT/DS292/R, WT/DS293/R (Sept. 29, 2006) [hereinafter Panel Report, *EC-Approval and Marketing of Biotech Products*].

information presents “insufficient evidence” for the maintenance of a trade restrictive measure. Although most adjudicators are not trained scientists, they find themselves applying legal language and categorizations to complicated scientific conclusions.

This Article attempts to understand the regulatory philosophy that underlies the jurisprudence of the WTO in the field of risk regulation in the context of the SPS Agreement. While taking account of the interpretative methods of WTO dispute settlement, the focus of this Article is on two separate but interrelated aspects: First, Part I of this Article explains the distinct languages and methodologies that science, on the one hand, and law, on the other, use. After reviewing the treaty language and the existing WTO jurisprudence in Part II, Part III turns to the different methods or “transmission belts” that can be used to translate scientific insights, or lack thereof, into legal categories. Part IV makes the second substantive point by analyzing the panels’ and the Appellate Body’s (“AB”) underlying jurisprudential view of risk regulation. It demonstrates that the approach taken by the panel level differs considerably from that taken by the AB, thus making it more difficult to find a coherent legal framework for these questions. Finally, Part V provides a summary of the findings and draws conclusions.

I. *THE LANGUAGES OF SCIENCE AND LAW*

The starting point for the present inquiry is the distinction between the languages and methods that both science and law use as a matter of course in their respective disciplines. While it is natural that a particular discipline develops its own approaches, methodology, and specific language to express ideas and rationales, this development also leads to a dichotomy of conversations when actors in one field (try to) communicate with those from an unrelated discipline.¹² As will be pointed out in greater detail below, certain provisions of the SPS Agreement, as well as other parts of WTO law, either explicitly or impliedly mandate the use of scientific evidence in order to justify

12. See generally Robin Feldman, *Historic Perspectives on Law & Science*, 2009 STAN. TECH. L. REV. 1 (discussing the law’s misunderstanding of science).

domestic measures that limit or prohibit in their entirety the importation of particular goods. Thus, not only the design of the SPS Agreement, but also the increased awareness of risks to either health or the environment in more general terms, mandate a bridging of disciplines that employ different languages and methodologies.

A. *The Language of Science*

Science has been described as being “progressive,” employing “methods designed to approach a better understanding over time.”¹³ The “object” of scientific inquiry is “to figure out answers to questions about the world and how it works.”¹⁴ This signifies an evolutionary methodology: knowledge is acquired through a succession of inquiries, which ideally verify a particular observation made or confirm a theoretical assertion. In at least the majority of cases, this also means that having found a particular answer, or in some cases, failure to do so, may pave the way for additional questions that require additional research.

Moreover, two interrelated aspects characterize scientific investigation: it is by nature an open-ended inquiry process that at least in theory must always be revisable.¹⁵ Under a different set of circumstances there is at least a logical possibility that a particular assertion could be falsified. Secondly, the tools and techniques that are being used to gain a more thorough understanding of a particular phenomenon are themselves subject to change. This change may in turn yield a different understanding, either because the results are more refined or yield different conclusions altogether.

Importantly, there is no single “scientific method” that can be followed in a formalized way and none that guarantees additional insights.¹⁶ That in turn means that each field may have their own discreet and distinct procedure that yields the best results. For example, the differences between physics and

13. Douglas Crawford-Brown et al., *Environmental Risk, Precaution, and Scientific Rationality in the Context of WTO/NAFTA Trade Rules*, 24 *RISK ANALYSIS* 461, 462 (2004).

14. Susan Haack, *Irreconcilable Differences? The Troubled Marriage of Science and Law*, 72 *LAW & CONTEMP. PROBS.* 1, 7 (2009).

15. See KARL R. POPPER, *THE LOGIC OF SCIENTIFIC DISCOVERY* 281 (1992).

16. Haack, *supra* note 14, at 8.

biology are instructive. While the former has been called “a breathtaking example of mathematical elegance combined with fantastically accurate predictions,” the latter is characterized by the central paradigm of evolution giving the field a higher degree of complexity.¹⁷ Because of this complexity “no one seems to think that [the features of this complexity] can be predicted in any detail on the basis of a deductive theory.”¹⁸ Over time, a particular field of science may thus attain a common and shared understanding of the underpinnings of its discipline. Such a consensus—be it one that supports an assertion that was originally thought of as being invalid or be it one that was originally embraced but which turned out to be insupportable in the end—arises not by formal voting but only as a byproduct when enough members of the relevant scientific subcommunity come to regard the evidence as strong enough to warrant this claim or that theory.¹⁹ Note that already at this stage, the idea that science is an objective or neutral arbiter of disputes can be questioned. The very idea of a particular hypothesis being accepted through members of a community is itself a value-laden judgment.²⁰

As will be laid out in greater detail below, science itself is ideally policy-neutral. This is, of course, not to say that science is not policy-relevant, but rather that scientific inquiry is disinterested in the policy outcome that follows any revelation, through publication or otherwise, of the results of the scientific inquiry. All of this leads to conclusions that are stated in rather cautious terms.²¹ Statements may thus be preceded by “there is some evidence that” or “there is no acceptable evidence that.”²²

17. Daniel A. Farber, *Toward a New Legal Realism*, 68 U. CHI. L. REV. 279, 295 (2001).

18. *Id.*

19. *Id.* at 10. Or, as Paul Feyerabend writes, “[s]cience is an essentially anarchistic enterprise.” PAUL FEYERABEND, *AGAINST METHOD: OUTLINE OF AN ANARCHISTIC THEORY OF KNOWLEDGE* 17 (Verso 1978) (1975).

20. See THOMAS S. KUHN, *THE ESSENTIAL TENSION: SELECTED STUDIES IN SCIENTIFIC TRADITION AND CHANGE* 320–39 (1977); Richard Rudner, *The Scientist Qua Scientist Makes Value Judgments*, 20 PHIL. SCI. 1, 4 (1953).

21. Richard Wilson & E.A.C. Crouch, *Risk Assessment and Comparisons: An Introduction*, 236 SCIENCE 267, 268 (1987).

22. STEPHEN BREYER, *BREAKING THE VICIOUS CIRCLE: TOWARD EFFECTIVE RISK REGULATION* 48 (1993); see also Ernan McMullin, *Values in Science*, in *INTRODUCTORY READINGS IN THE PHILOSOPHY OF SCIENCE* 515, 519–20 (E.D. Klemke et al. eds., 1998).

This has led scientists to argue that in order to relay as full an understanding as possible, risk may have to be expressed “in as many different ways as possible.”²³

B. *The Language of Law*

Law employs both a different language and a different methodology. As expressed by Justice Blackmun in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, “there are important differences between the quest for truth in the courtroom and the quest for truth in the laboratory. Scientific conclusions are subject to perpetual revision. Law, on the other hand, must resolve disputes finally and quickly.”²⁴

This passage from *Daubert* summarizes some of the differences between the worlds of science and law.²⁵ Language is one of the central elements for legal adjudication. It makes a difference whether a sentence contains an “and” as opposed to an “or;” it affects the outcome of a decision whether a text contains the indefinite article “a” or the definite article “the.”²⁶

The legal process also has a different objective: the resolution of a particular conflict between two or more parties at a particular moment in time. Unlike science, a plethora of rules exist to guide the procedure in adjudicatory processes—for example, the exclusion of potentially relevant evidence, which of the parties carries the burden of proof, and how much time a party has to establish an assertion made.²⁷ By definition and due to their forthcoming, these rules are themselves value-laden. Sometimes they are extrinsic, having nothing at all to do with a neutral inquiry into the truth. An example in the realm of criminal law is the exclusion of evidence that was acquired

23. Wilson & Crouch, *supra* note 21, at 270.

24. 509 U.S. 579, 596–97 (1993).

25. Note that WTO law differs in important respects in that it does not possess the strict binary nature of cases such as *Daubert*. Panel and AB decisions are often characterized by including wide-ranging policy decisions and thus far larger implications than for the immediate case to be decided.

26. One of the more famous examples in public international law is the debate surrounding a resolution by the United Nations Security Council concerning the situation in Israel. *See generally* LORD CARADON ET AL., U.N. SECURITY COUNCIL RESOLUTION 242, A CASE STUDY IN DIPLOMATIC AMBIGUITY 22, 46 (1981); SYDNEY D. BAILEY, THE MAKING OF RESOLUTION 242 at 152–58 (1985).

27. Crawford-Brown et al., *supra* note 13, at 462; Haack, *supra* note 14, at 13.

improperly, such as if the prosecution were to obtain evidence in an unlawful manner or withhold evidence from the defense.

The role of the lawyer, having to act in the best interest of the client, is in almost complete contradistinction to that of a disinterested scientist. If the latter is an inquirer, starting out with a question to answer, the former is an advocate, trying to persuade the adjudicator of a particular position and trying to provide as many arguments in support thereof as possible. While the role of a judge is by design more neutral, a judge still operates in an environment where the search for truth is—often for good reasons—constrained. The character of adversarial judicial proceedings in which the parties furnish the experts implies the use of scientific experts who may express more certainty than the scientific underpinnings would allow. This means that looking at expert testimony on a spectrum, with the representatives on the outer bounds claiming certainty for their own—often mutually contradictory—opinions, genuine scientific debate tends to happen in the center where certainty is muted, positions not fully contradictory and representatives at least open to accepting another fellow scientist’s assessment.²⁸

Court proceedings—and this is especially true in the case of the WTO²⁹—are characterized by time limits that emphasize the resolution of the conflict at hand within a reasonable period. Moreover, legal decisions are considered to be definitive—at least once all options for appeals have been exhausted. An individual decision thus has an inherent element of finality, one that—very much unlike the scientific process—does not evolve or change over time.³⁰

28. For an analysis of how the adversarial legal system has a tendency to make experts appear to be certain about scientifically contestable findings, see Haack, *supra* note 14, at 16.

29. PETER VAN DEN BOSSCHE, *THE LAW AND POLICY OF THE WORLD TRADE ORGANIZATION: TEXT, CASES AND MATERIALS* 200, 287–88 (2d ed. 2008). Under the Dispute Settlement Understanding (“DSU”) rules, panel proceedings are to be finished in less than nine months, Appellate Body (“AB”) proceedings are not to last longer than ninety days. Both timeframes are regularly exceeded. *See id.*; *Timing of Appeal, Circulation and Adoption of Appellate Body Reports*, WORLDTRADELAW.NET, <http://www.worldtradelaw.net/dsc/database/abtiming.asp> (last visited Sept. 12, 2011).

30. The finality of a particular dispute stands in contrast to the evolving long-term development of legal doctrines and which, depending on the legal system, can have a considerable impact on subsequent decision-making. Such an evolution may respond

C. The Significance of the Debate

The relevance of this disparity becomes evident in situations where a scientific expert is called to testify before a body tasked with making decisions based on legal rules. Challenges arise in a variety of circumstances.

Questions posed by an adjudicator may be based on legal logic and may lack an understanding of how the scientific process works. This became evident in the panel proceedings in *United States–Continued Suspension of Obligations in the EC–Hormones Dispute* (“*US–Continued Suspension*”).³¹ At numerous points in the hearing, the panel members indicate their unfamiliarity with the scientific process. For example, one of the panelists asked: “I take it then that the answer is there is no new scientific information that would fundamentally change what was already analysed in the 1999 review.”³² The expert’s response pointed out that he could not answer that question with a sufficient degree of certainty,³³ and was again pressed by another panelist on that point.³⁴ It is imperative that panelists understand the process of scientific experimentation and what weight is to be given to empirical data in the face of uncertainty about the explanatory effect of a particular theory. Scientists, on the other hand, may understand a question concerned with legal categorization on purely scientific terms, therefore leaving out information that would otherwise be considered important.

A statement by an expert to the effect that she or he cannot attest to whether a particular substance or a process is dangerous or whether a particular outcome is solely based on the introduction of one particular substance could be interpreted ambiguously. Even a statement such as “I do not know” may have a different meaning. It may simply imply that there is not enough information—the appropriate response to which is most likely not to ignore something simply because it is

to changing societal attitudes or scientific insights as well as the introduction of new methods of evidence gathering.

31. See generally Panel Report, *United States–Continued Suspension of Obligations in the EC–Hormones Dispute*, WT/DS320/R (Mar. 31, 2008) [hereinafter Panel Report, *US–Continued Suspension*].

32. *Id.*, Annex G, ¶ 656.

33. *Id.* ¶ 662.

34. *Id.* ¶ 663.

not a proven hazard.³⁵ For a scientist, his or her statement would necessarily be understood to have validity only under the conditions under which the particular experiment was conducted. This means that scientific testimony is rarely unqualified, but rather inherently limited. The language of law, on the other hand, is absolute and usually employs a binary decision-making process because something must be considered to be either legal or illegal. Individuals being tasked with making legal decisions are therefore put into a position to ascertain the language of scientists and translate it into one of the two legal categories. One can arguably claim that, for example, the principle of proportionality or the requirement to take extenuating circumstances into account in criminal proceedings can ameliorate inequitable or wholly unfair outcomes. But even before reaching that particular stage in the decision-making process, the different languages may have already paved the way for a legal conclusion to which a scientist may not have imagined a particular statement could lead.³⁶

An additional challenge presents itself in situations in which scientists differ as to the conclusions to be drawn from a particular set of scientific data. As was true in all decisions in the WTO context concerning the use of scientific evidence, the opposing parties to the dispute presented expert testimony as to the viability of their respective positions.³⁷ In such situations,

35. See Wilson & Crouch, *supra* note 21, at 267–68.

36. This is not to say that legal decisions are never complex. Oftentimes, adjudicatory processes take a long time and complicated issues must be resolved. This may be gleaned, in the context of WTO law, from the increasing time it takes to reach a decision at both the panel and the AB stage. For a detailed account of the timing involved at the AB stage, see *Timing of Appeal, Circulation and Adoption of Appellate Body Reports*, *supra* note 29. No matter how complex a particular decision-making process may have been, however, the ultimate decision a court makes is of a binary nature.

37. See Panel Report, *Australia–Measures Affecting Importation of Salmon*, WT/DS18/R (June 12, 1998) [hereinafter Panel Report, *Australia–Salmon*]; Panel Report, *EC–Hormones*, *supra* note 10; Panel Report, *EC Measures Concerning Meat and Meat Products (Hormones)*, WT/DS48/R/CAN (Aug. 18, 1997) [hereinafter Panel Report, *EC–Hormones (Canada)*]; Panel Report, *Japan–Measures Affecting Agricultural Products*, WT/DS76/R (Oct. 27, 1998) [hereinafter Panel Report, *Japan–Agricultural Products III*]; Panel Report, *Japan–Measures Affecting the Importation of Apples*, WT/DS245/R (July 15, 2003) [hereinafter Panel Report, *Japan–Apples*]; Panel Report, *EC–Approval and Marketing of Biotech Products*, *supra* note 11; Panel Report, *US–Continued Suspension*, *supra* note 31. The relevant AB reports are Appellate Body Report, *Australia–Measures Affecting Importation of Salmon*, WT/DS18/AB/R, (Oct. 20, 1998) [hereinafter Appellate Body Report, *Australia–Salmon*]; Appellate Body Report,

scientific experts may disagree on the facts underlying the case or may have differing views as to the certainty of particular statements in light of the evidence that they or others could find. They may also differ as to how much weight to give factors such as direct empirical evidence, semi-empirical evidence, empirical correlation, theory-based inference, or even existential insight.³⁸ An adjudicator may end up in the unenviable position of nevertheless having to make a finding as to the legality of a particular trade measure without being able to rely on a sufficient amount of certainty.

A statement by a scientist as to the inability to attest to the toxicity of a certain substance may thus be understood by a non-scientist WTO member as operating “without sufficient evidence.” As will be seen in the next section, such a lack of understanding of the scientific process can have a significant impact on, and in some instances can determine, the outcome of cases in WTO proceedings.

An additional element complicates matters in cases before the WTO dispute settlement organs. As has been pointed out numerous times, the AB has employed a textual approach to interpreting WTO treaty language.³⁹ Ostensibly based on

European Communities—Measures Concerning Meat and Meat Products (Hormones), WT/DS26/AB/R & WT/DS48/AB/R (Jan. 16, 1998) [hereinafter Appellate Body Report, *EC—Hormones*]; Appellate Body Report, *Japan—Measures Affecting Agricultural Products*, WT/DS76/AB/R (Feb. 22, 1999) [hereinafter Appellate Body Report, *Japan—Agricultural Products II*]; Appellate Body Report, *Japan—Measures Affecting the Importation of Apples*, WT/DS245/AB/R (Nov. 26, 2003) [hereinafter Appellate Body Report, *Japan—Apples*]; Appellate Body Report, *United States—Continued Suspension of Obligations in the EC—Hormones Dispute*, WT/DS320/AB/R (Oct. 16, 2008) [hereinafter Appellate Body Report, *US—Continued Suspension*].

38. Crawford-Brown et al., *supra* note 13, at 465. Arguably, at least, the last element, which is “rooted in a purely subjective judgment of risk,” is no longer part of a strict scientific process, but rather a conclusory aspect as to how to manage a risk that has been identified. *Id.* For more detail, see DOUGLAS J. CRAWFORD-BROWN, RISK-BASED ENVIRONMENTAL DECISIONS: CULTURE AND METHODS 52–53 (1999).

39. See, e.g., David Palmetier & Petros C. Mavroidis, *The WTO Legal System: Sources of Law*, 92 AM. J. INT’L L. 398, 398 (1998); Bryan Mercurio & Mitali Tyagi, *Treaty Interpretation in WTO Dispute Settlement: The Outstanding Question of the Legality of Local Working Requirements*, 19 MINN. J. INT’L L. 275, 302 (2010); Claus-Dieter Ehlermann, *Six Years on the Bench of the “World Trade Court:” Some Personal Experiences as Member of the Appellate Body of the World Trade Organization*, 36 J. WORLD TRADE 605, 616 (2002); Federico Ortino, *Treaty Interpretation and the WTO Appellate Body Report in US—Gambling: A Critique*, 9 J. INT’L ECON. L. 117, 122–24 (2006); Michael Lennard, *Navigating by the Stars: Interpreting the WTO Agreements*, 5 J. INT’L ECON. L. 17, 87 (2002).

Article 31 of the Vienna Convention on the Law of Treaties⁴⁰ and, arguably more importantly, out of concern for the legitimacy of the WTO dispute settlement process in its infant stage,⁴¹ the AB's interpretation has been characterized by an explicit reliance on dictionaries for definitional purposes and by avoiding other means of interpretation as much as possible. It thus stands in marked contrast to other judicial institutions on the international plane, most of all the jurisprudential approach of the Court of Justice of the European Union.⁴² It has been argued that this approach is nothing but a mask or a "pretense" and that "any critical reading of the case law will show that when it appears fit the AB is no less teleological, contextual, or systematic than any other tribunal of similar standing."⁴³ The problem then is that (overly) strong reliance on a textual approach comes at the expense of "the richer contextual matrix of its decisions"⁴⁴ and potentially an inability to take account of the wider background before which science operates.

II. WTO LAW AND RISK SCIENCE: THE SPS AGREEMENT

The SPS Agreement⁴⁵ —under which members are permitted to take measures to protect, within their own

40. Vienna Convention on the Law of Treaties art. 31, May 23, 1969, 1155 U.N.T.S. 331.

41. For more information on sources of legitimacy of the WTO dispute settlement process, see Yuka Fukunaga, *Civil Society and the Legitimacy of the WTO Dispute Settlement System*, 34 BROOK. J. INT'L L. 85, 111–12 (2008).

42. See Ehlermann, *supra* note 39, at 616.

43. Henrik Horn & Joseph H.H. Weiler, *European Communities—Trade Description of Sardines: Textualism and Its Discontent*, in THE WTO CASE LAW OF 2002 248, 252 (Henrik Horn & Petros C. Mavroidis eds., 2005).

44. *Id.* at 255.

45. This section outlines the pertinent legal issues with regard to the SPS Agreement. Other agreements contained in the annexes to the WTO Agreement face similar challenges, notably the questions dealt with in this section also appear in the jurisprudence of Article XX of the GATT. Furthermore, similar questions pertaining to the assessment of risk to the economy of a WTO member (and therefore not human, animal, or plant life or health) also arise in the context of the Agreement on Implementation of Article VI of the General Agreement on Tariffs and Trade 1994, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, 1868 U.N.T.S. 201, as well as the Agreement on Subsidies and Countervailing Measures, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, 1867 U.N.T.S. 14. These may necessitate a different approach when dealing with such risks.

territory, the life and health of humans, animals, and plants from, inter alia, pests, diseases, additives, and contaminants—employs a science-based approach for the invocation of trade-restricting measures.⁴⁶

The SPS Agreement explicitly mandates that measures instituted by WTO members be “based on scientific principles” and that they are “not maintained without sufficient scientific evidence.”⁴⁷ Members are strongly encouraged to follow international standards in developing internal measures.⁴⁸ The use of such standards creates a presumption of compliance with the terms of the SPS Agreement, and any deviation must be specifically justified on the part of the country opting for a higher level of protection than that set forth in the international standard.⁴⁹ Thus, the SPS Agreement allows for a deviation from international standards, provided that there is “a scientific justification” and provided that the additional requirements under Article 5 of the SPS Agreement are met.⁵⁰ These requirements include carrying out a risk assessment,⁵¹ in the process of which members “shall take into account available scientific evidence.”⁵² Provisional measures may be taken “where relevant scientific evidence is insufficient,” but “[m]embers shall seek to obtain the additional information necessary for a more objective assessment of risk . . . within a reasonable period of time.”⁵³

A. *Scientific Justification*

Given the overarching ideal of the WTO, laid down, for example, as the “elimination of discriminatory treatment,”⁵⁴ it is

46. See SPS Agreement, *supra* note 5, Annex A, ¶ 1, for the definition of an SPS measure.

47. *Id.* art. 2.2.

48. See, e.g., *id.* art. 3.

49. See *id.* art. 3.3.

50. See, e.g., Appellate Body Report, *Australia–Salmon*, *supra* note 37, ¶¶ 237–45, (discussing the need for “scientific evidence” and a risk assessment meeting Article 5’s requirements).

51. SPS Agreement, *supra* note 5, art. 5.1.

52. *Id.* art. 5.2.

53. *Id.* art. 5.7.

54. See Marrakesh Agreement Establishing the World Trade Organization pmbl. 3, Apr. 15, 1994, 1867 U.N.T.S. 154. Similar language can be found in the Preamble of the SPS Agreement. See SPS Agreement, *supra* note 5, pmbl. (requiring that measures

not surprising that SPS measures must be taken on a rational basis. While Article 2.1 of the SPS Agreement allows WTO members to take SPS measures, Article 2.2 SPS Agreement mandates that this be done with a considerable amount of scrutiny. It sets a limit on the breadth of the measure (“only to the extent necessary”) including a proportionality requirement and requires that any measure be based on “scientific principles and . . . not maintained without sufficient scientific evidence.”⁵⁵ While the case law has clarified the provision to some extent, the exact relationship between Article 2.2 and Article 5.1 is still not clear.⁵⁶ In its case law, the AB pointed out that the two provisions should be read in conjunction with one another, as Article 5.1 was found to be a “specific application of the basic obligations contained in Article 2.2.”⁵⁷

What emerges from the case law is the following: the term “scientific evidence” was interpreted, relying on dictionary definitions, as meaning “‘of, relating to, or used in science,’ ‘broadly, having or appearing to have an exact, objective, factual, systematic or methodological basis,’ ‘of, relating to, or exhibiting the methods or principles of science’ and ‘of, pertaining to, using, or based on the methodology of science.’”⁵⁸ While these definitions are not necessarily satisfactory, the more problematic element of the term is the word “sufficient.”⁵⁹ According to the AB, the term implies a “relational concept” and requires “the existence of a sufficient or adequate relationship . . . between the SPS measure and the scientific evidence.”⁶⁰ In a subsequent case, the AB attempted to clarify this finding by stating that the relationship needs to be “rational

not be “applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination”).

55. See SPS Agreement, *supra* note 5, arts. 2.1, 2.2; Anja Seibert-Fohr, *Article 2 SPS*, in 3 MAX PLANCK COMMENTARIES ON WORLD TRADE LAW: WTO-TECHNICAL BARRIERS AND SPS MEASURES ¶¶ 12, 17–18 (Rüdiger Wolfrum et al. eds., 2007).

56. See Lukasz Gruszczynski, *Science in the Process of Risk Regulation under the WTO Agreement on Sanitary and Phytosanitary Measures*, 7 GER. L.J. 371, 375–77 (2006).

57. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 180. This ruling was confirmed in Appellate Body Report, *Japan–Agricultural Products II*, *supra* note 37, ¶ 82.

58. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 187, ¶ 187 n.172.

59. See SPS Agreement, *supra* note 5, art. 2.2 (“[N]ot maintained without sufficient scientific evidence . . .”); SPS Agreement, *supra* note 5, art. 5.7 (“In cases where relevant scientific evidence is insufficient . . .”).

60. Appellate Body Report, *Japan–Apples*, *supra* note 37, ¶ 73.

or objective,” requiring verifiable data to support the conclusions arrived at,⁶¹ which, in turn, requires at least a “certain level of objectivity.”⁶² Without prejudice to the precautionary principle contained in Article 5.7 of the SPS Agreement, this would imply that the more trade-restrictive a measure is, the higher the evidentiary threshold. On the other hand, the AB went to great lengths to point out that even at this stage of the process, panels should take account of the fact that “responsible, representative governments commonly act from perspectives of prudence and precaution where risks of irreversible, e.g. life-terminating, damage to human health are concerned.”⁶³

B. Higher Level of Protection Requires Scientific Justification

The SPS Agreement presumes that a country is in compliance with its disciplines if a member’s measures are “based on the relevant international standards, guidelines or recommendations.”⁶⁴ It therefore seeks to harmonize the application of domestic SPS measures with international standards.⁶⁵ These standards, guidelines, and recommendations are not elaborated on by the WTO, but rather, Annex A(3) of the SPS Agreement refers to specific organizations in their respective fields.⁶⁶ At the same time, the SPS Agreement recognizes—at least on its face—regulatory autonomy for WTO

61. *Id.* ¶ 114.

62. Panel Report, *Australia–Salmon*, *supra* note 37, ¶ 7.48.

63. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 124.

64. SPS Agreement, *supra* note 5, art. 3.3.

65. See Terence P. Stewart & David S. Johanson, *The SPS Agreement of the World Trade Organization and the International Trade of Dairy Products*, 54 *FOOD & DRUG L.J.* 55, 57 (1999); Victor, *supra* note 5, at 875.

66. The relevant organizations are:

[F]or food safety, the standards, guidelines and recommendations established by the Codex Alimentarius Commission relating to food additives, veterinary drug and pesticide residues, contaminants, methods of analysis and sampling, and codes and guidelines of hygienic practice; for animal health and zoonoses, the standards, guidelines and recommendations developed under the auspices of the International Office of Epizootics; for plant health, the international standards, guidelines and recommendations developed under the auspices of the Secretariat of the International Plant Protection Convention in cooperation with regional organizations operating within the framework of the International Plant Protection Convention

SPS Agreement, *supra* note 5, Annex A ¶ 3(a)–(c).

members: the agreement allows members to impose measures that result in a higher level of SPS protection, under the condition that the member provides a scientific justification for the deviation or its measure comports with the strictures of Article 5.⁶⁷

The early case law left uncertainties over whether Article 3.3 allowed for these two alternatives.⁶⁸ The more permissive interpretation would have allowed members significantly more decisional autonomy and would have alleviated the members from the rather onerous requirements under Article 5. This uncertainty was criticized by the AB in *EC–Measures Concerning Meat and Meat Products (Hormones)* (“*EC-Hormones*”) when it said that “Article 3.3 is evidently not a model of clarity in drafting and communication.”⁶⁹ The AB provided that clarity in the same decision by eviscerating the provision of all independent meaning. The disjunctive “or” was effectively turned into a conjunctive “and.”⁷⁰ It based its decision on the last sentence of Article 3.3, which provides that higher levels of SPS protection “shall not be inconsistent with any other provision of this Agreement,” as well as the text of the footnote in the official text which was held to essentially embody the requirements of Article 5 of the SPS Agreement.⁷¹

C. Dealing with Risk

Scientific evidence is therefore the lynchpin of compliance with the SPS Agreement should a WTO member decide to deviate from the international standard in a particular area. It must then carry out a risk assessment under Articles 5.1–5.3, the intensity of which depends on what type of measure is at issue.

Early panel decisions⁷² and some commentators⁷³ distinguish between two stages in the process of how to deal with

67. See SPS Agreement, *supra* note 5, art. 3.3.

68. See Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 175.

69. See *id.* ¶ 175.

70. See *id.* ¶¶ 175, 177.

71. See *id.* ¶ 175; SPS Agreement, *supra* note 5, art. 3.3.

72. See, e.g., Panel Report, *EC–Hormones (Canada)*, *supra* note 37, ¶¶ 8.94–8.98; Panel Report, *EC–Hormones*, *supra* note 37, ¶¶ 8.91–8.95.

73. See VAN DEN BOSSCHE, *supra* note 29, at 852–62; Jeremy D. Fraiberg & Michael J. Trebilcock, *Risk Regulation: Technocratic and Democratic Tools for Regulatory Reform*, 43 MCGILL L.J. 835, 849 (1998); Christian Joerges, *Law, Science and the Management of Risks*

risk by separating the risk assessment from risk management. This distinction existed in domestic mechanisms, for example in the United States, well before it appeared in WTO jurisprudence.⁷⁴ In the US context, the former is—in an idealized form—understood to mean a “characterization of the potential adverse health effects of human exposures to environmental hazards.”⁷⁵ Risk management is the second step and means a “process of identifying, evaluating, selecting, and implementing actions to reduce risk to human health and to ecosystems. The goal of risk management is to create scientifically sound, cost-effective, integrated actions that reduce or prevent risks while taking into account social, cultural, ethical, political, and legal considerations.”⁷⁶

The same approach was taken by the Panel in response to the US and Canadian complaints in *EC–Hormones*, which drew a distinction between the two phases of risk assessment and risk management,⁷⁷ a move roundly rejected by the AB. The Panel drew what it saw as a clear distinction between the two stages. Risk assessment, defined as “a *scientific* examination of data and factual studies,” is unlike risk management because it is “not a policy exercise involving social value judgments made by political bodies.”⁷⁸ Risk management “involves social value

to Health at the National, European and International Level—Stories on Baby Dummies, Mad Cows and Hormones in Beef, 7 COLUM. J. EUR. L. 1, 15 (2001); Vern R. Walker, *Keeping the WTO from Becoming the “World Trans-Science Organization”: Scientific Uncertainty, Science Policy, and Factfinding in the Growth Hormones Dispute*, 31 CORNELL INT’L. L.J. 251, 255, 267–77 (1998).

74. See, e.g., COMM. ON THE INSTITUTIONAL MEANS FOR ASSESSMENT OF RISKS TO PUB. HEALTH, NAT’L RESEARCH COUNCIL, RISK ASSESSMENT IN THE FEDERAL GOVERNMENT: MANAGING THE PROCESS 18–19 (1983). Note however that the Committee was aware that its separation between risk assessment and risk management could be undermined by policy considerations. See *id.* at 33–37; see also BREYER, *supra* note 22, at 9; WILLIAM W. LOWRANCE, OF ACCEPTABLE RISK: SCIENCE AND THE DETERMINATION OF SAFETY 8 (1976).

75. COMM. ON THE INSTITUTIONAL MEANS FOR ASSESSMENT OF RISKS TO PUB. HEALTH, *supra* note 74, at 18. The document points out that this definition has not been universally accepted, with critics contending that risk assessment should only take account of quantitative elements as opposed to qualitative factors. *Id.*

76. 1 PRESIDENTIAL/CONG. COMM’N ON RISK ASSESSMENT AND RISK MGMT., FRAMEWORK FOR ENVIRONMENTAL HEALTH RISK MANAGEMENT 1 (1997).

77. See Panel Report, *EC–Hormones (Canada)*, *supra* note 37, ¶¶ 8.94–8.100; Panel Report, *EC–Hormones*, *supra* note 10, ¶¶ 8.91–8.160.

78. Panel Report, *EC–Hormones (Canada)*, *supra* note 37, ¶¶ 8.97, 8.163; Panel Report, *EC–Hormones*, *supra* note 10, ¶¶ 8.94, 8.160.

judgments” such that “[o]nce the risks have been assessed, i.e., once the risks and their probability of occurrence [are] identified, a Member will need to decide, on the basis of its own value judgments, whether it can accept these risks.”⁷⁹ The AB, however, rejected this understanding on two grounds: 1) it found no basis in Article 5 of the SPS Agreement, nor in any other provision, for this distinction;⁸⁰ 2) it understood Article 5.2, which indicates factors to be taken into account in assessing the risk, to be an open-ended list.⁸¹ Its approach recognized, as mentioned above, that the measures contemplated by members did not take place in a laboratory, but rather in “human societies as they actually exist, in other words, the actual potential for adverse effects on human health in the real world where people live and work and die.”⁸² This interpretation itself is not free from criticism. While it broadened the scope of factors that may be taken into consideration and allowed for a more holistic approach, it also deviated from the language of Article 2.2, which provides context to Articles 5.1 through 5.3,⁸³ and which demands that SPS measures be based on “sufficient scientific evidence.”⁸⁴

Whether this means that non-scientific factors, including cultural or subjective factors that shape the perceptions of risk, can be taken into account in the decision-making process leading up to the institution of the measure⁸⁵ was not addressed

79. *Id.*

80. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 181.

81. *Id.* ¶ 187; *see also* Reinhard Quick & Andreas Blüthner, *Has the Appellate Body Erred?: An Appraisal and Criticism of the Ruling in the WTO Hormones Case*, 2 J. INT’L ECON. L. 603, 617–18 (1999).

82. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 187.

83. *See, e.g.*, Appellate Body Report, *US–Continued Suspension*, *supra* note 37, ¶ 526.

84. Quick & Blüthner, *supra* note 81, at 617–19. The authors suspect that one of the AB’s motives for this move was to make the ruling “politically acceptable.” *Id.* at 618.

85. *See, e.g.*, Alessandra Arcuri, *Food Safety at the WTO after ‘Continued Suspension’: A Paradigm Shift?*, in *THE EUROPEAN UNION AND GLOBAL EMERGENCIES: A LAW AND POLICY ANALYSIS* 205, 208–12 (Antonis Antoniadis et al. eds., 2011); M. Gregg Bloche, *WTO Deference to National Health Policy: Toward an Interpretive Principle*, 5 J. INT’L ECON. L. 825, 836 (2002); Caroline E. Foster, *Public Opinion and the Interpretation of the World Trade Organisation’s Agreement on Sanitary and Phytosanitary Measures*, J. INT’L ECON. L. 427, 427 (2008); Vern R. Walker, *The Myth of Science as a “Neutral Arbiter” for Triggering Precautions*, 26 B.C. INT’L & COMP. L. REV. 197, 198 (2003); David Winickoff et al., *Adjudicating the GM Food Wars: Science, Risk, and Democracy in World Trade Law*, 30 YALE J. INT’L L. 81, 85 (2005); TRACEY EPPS, *INTERNATIONAL TRADE AND HEALTH*

by the AB in its rulings and remains an open question. The track record following the AB's decision in *EC–Hormones* indicates a cautious openness to undeterminable scientific factors, although scientific evidence has played—by far—the greater role.⁸⁶ The AB's ruling does however take account of the fact that the idealized and almost sterile version of science that the Panel—somewhat naively—promoted was neither commensurate with the realities of scientific exploration in which non-scientific factors do play a role,⁸⁷ nor the requirements of deliberative democratic forms of governance,⁸⁸ nor did it appear cognizant of the complex interplay between various factors that create risks outside of the laboratory setting.

I. Risk Assessment Stage

The AB's understanding of risk assessment as “a process characterized by systematic, disciplined and objective inquiry and analysis, that is, a mode of studying and sorting out facts and opinions” had been established since the original *EC–Hormones* dispute⁸⁹ and had been confirmed by the AB in *United States–Continued Suspension of Obligations in the EC–Hormones Dispute* (“*US–Continued Suspension*”).⁹⁰ As laid out in the AB report in *Australia–Measures Affecting Importation of Salmon*,⁹¹ the SPS Agreement distinguishes between two types of measures: so-called quarantine risk, that is, “the likelihood of entry,

PROTECTION: A CRITICAL ASSESSMENT OF THE WTO'S SPS AGREEMENT (Cheltenham: Edward Elgar, 2008). It is arguable that, as Bloche claims, there is only a “low empirical barrier” to be crossed. Rather, the AB's jurisprudence in Appellate Body Report, *EC–Hormones* allows deference to domestic decision-making once substantial empirical barriers are overcome. Bloche, *supra*, at 837.

86. See Seibert-Fohr, *supra* note 55, ¶ 27; Marcos A. Orellana, *Evolving WTO Law Concerning Health, Safety and Environmental Measures*, 1 TRADE, L. & DEV. 103, 122–26 (2009).

87. See, e.g., Appellate Body Report, *US–Continued Suspension*, *supra* note 37, ¶¶ 480–82 (finding relevant the institution in which an expert works and the possible effects thereof on the expert's impartiality).

88. See Robert Howse, *Democracy, Science, and Free Trade: Risk Regulation on Trial at the World Trade Organization*, 98 MICH. L. REV. 2329, 2343 (2000); Jacqueline Peel, *Risk Regulation Under the WTO SPS Agreement: Science as an International Normative Yardstick?* 90 (N.Y. Univ. Sch. of Law, Jean Monnet Working Paper, Working Paper No. 02/04, 2004), available at <http://centers.law.nyu.edu/jeanmonnet/papers/04/040201.pdf>.

89. See Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 187.

90. See Appellate Body Report, *US–Continued Suspension*, *supra* note 37, ¶ 527.

91. See Appellate Body Report, *Australia–Salmon*, *supra* note 37, ¶¶ 120–21.

establishment or spread of a pest or disease within the territory of an importing Member,”⁹² and so-called food-borne risks, that is, the “potential for adverse effects on human or animal health arising from the presence of additives, contaminants, toxins or disease-causing organisms in food, beverages or feedstuffs.”⁹³ The AB was careful to point out the distinction between the “likelihood of entry” on the one hand and the “potential for adverse effects,” the former mandating a higher degree of certainty in that there must not only exist some abstract possibility of entry, establishment, or spread of diseases and associated biological and economic consequences, but also the assessment must—in either qualitative or quantitative terms⁹⁴—show the probability thereof.⁹⁵ That being said, the AB has long held that this does not require meeting a particular “magnitude or threshold level of risk.”⁹⁶

The methods of risk assessment are outlined in Article 5.2 and have been considerably supplemented by subsequent jurisprudence. As pointed out above, the AB declared early on that Article 5.2 does not represent a closed list, but rather that WTO members have a certain amount of discretion in choosing the methods for determining the risk that they have identified.⁹⁷ The AB has repeatedly reiterated this position since then, including in its latest report concerning the SPS Agreement.⁹⁸ Members also have discretion as to the so-called threshold level of risk that they are willing to accept before instituting their measures.⁹⁹ This recognized the need for domestic decision-makers to make decisions for which they could subsequently be held accountable.

92. SPS Agreement, *supra* note 5, Annex A, ¶ 4; see LUKASZ GRUSCZYNSKI, REGULATING HEALTH AND ENVIRONMENTAL RISKS UNDER WTO LAW 116 (2010).

93. Appellate Body Report, *Australia–Salmon*, *supra* note 37, ¶ 8.36; SPS Agreement, *supra* note 5, Annex A, ¶ 4.

94. Appellate Body Report, *Australia–Salmon*, *supra* note 37, ¶ 124; see also Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 187.

95. See Appellate Body Report, *Australia–Salmon*, *supra* note 37, ¶ 123.

96. See Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 186.

97. See *id.* ¶ 187.

98. See Appellate Body Report, *Australia–Salmon*, *supra* note 37, ¶¶ 207-08.

99. See Appellate Body Report, *Australia–Salmon*, *supra* note 37, ¶ 125; Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 124.

Despite later rulings on the panel stage to the contrary,¹⁰⁰ the AB has remained unambiguous regarding the nature of the inquiry a panel is supposed to perform: it does not exist to review the measures of WTO members *de novo* and therefore judge the substantive merits of an SPS measure; nor is its role to be fully deferential.¹⁰¹ A panel does not—and the panel proceedings in *US–Continued Suspension* confirms this—have the required expertise to fulfill this role. Nor would its adjudicatory function be fulfilled if its review was fully deferential. Rather, its function is to conduct—in line with Article 11 of the DSU—an “objective assessment of the facts,” meaning to “determine whether [the] risk assessment is supported by coherent reasoning and respectable scientific evidence.”¹⁰² This means that minority viewpoints in science are valid bases for determining the existence of risk, as long as they possess the “necessary scientific and methodological rigour to be considered reputable science.”¹⁰³ Importantly for present purposes, the AB’s analysis in *US–Continued Suspension* makes direct reference to the peer review mechanism outlined above: such minority views “must be considered to be legitimate science according to the standards of the relevant scientific community.”¹⁰⁴

This then outlines the task of a panel. In light of what it learns by way of experts, its role is to determine whether the measure that a WTO member puts in place is sufficiently warranted by the evidence provided. This determination is obviously easier to make when the basis for a particular assertion is mainstream scientific thinking. It requires meeting minimum epistemic standards as defined by the “relevant scientific community,” for which it may solicit the assistance of experts in the field.¹⁰⁵ It does not require putting forth the “best science,”

100. See, e.g., Appellate Body Report, *US–Continued Suspension*, *supra* note 37, ¶¶ 7.562–7.572 (reviewing the evidence and determining it did not support the measures taken by the European Communities).

101. See *id.* ¶ 589. Previously, the AB had reached a similar conclusion in Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 117.

102. See Appellate Body Report, *US–Continued Suspension*, *supra* note 37, ¶¶ 589–90.

103. See *id.* ¶ 591.

104. See *id.*

105. See *id.* ¶¶ 591–92.

but rather an inquiry into whether the views expressed by a WTO member meet such a threshold.¹⁰⁶

Finally, a WTO member does not have to conduct its own risk assessment, but can base its measures on the results of scientific processes carried out by international organizations or other members.¹⁰⁷ It does, however, have to be specific. What this means is that each substance that is considered to be a risk factor must be evaluated separately; it is not permissible to group substances together as the European Communities (“EC”) did in *EC–Hormones*. Rather, a separate assessment must be made for each substance in question with enough specificity as to the risks that each substance represents.¹⁰⁸ It appears that the AB mandates more stringent requirements than what the text of the agreement demands. This is especially true for so-called low-level risks, where the effect of a particular risk may be so low as to be almost undetectable. While the AB consistently declares that members can set their own levels of risk—at zero no less¹⁰⁹—there are situations in which the risk a substance poses may not be ascertainable as specifically as the AB demands, and instead, scientists may only be able to point to a general risk associated with a particular substance.¹¹⁰

This is especially troublesome as the AB does not fully take account of the multiplicity of sources from which a particular carcinogen may originate. It is thus insufficient to make the point that a particular substance is a known carcinogen and that residues of that carcinogen exist in meat. The AB would require more evidence showing a specific risk from hormone residues in the meat whose import was in question.¹¹¹ While this line of argument is ultimately not convincing in light of the potential dangers that such substances may pose, the AB has at least two

106. *See id.* ¶ 612.

107. *See* Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 190.

108. *See id.* ¶ 201.

109. *See* Appellate Body Report, *Australia–Salmon*, *supra* note 37, ¶ 125.

110. *See* Fraiberg & Trebilcock, *supra* note 73, at 849–50; Evanthia Diamanti-Kandarakis et al., *Endocrine-Disrupting Chemicals: An Endocrine Society Scientific Statement*, 30 ENDOCRINE REVS. 293, 324 (2009); Valerie J. Watnick, *Our Toxics Regulatory System and Why Risk Assessment Does Not Work: Endocrine Disrupting Chemicals as a Case in Point*, 2004 UTAH L. REV. 1305, 1322; *see also* Alan O. Sykes, *Domestic Regulation, Sovereignty, and Scientific Evidence Requirements: A Pessimistic View*, 3 CHI. J. INT’L L. 353, 364–65 (2002).

111. *See* Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 199.

arguments in defense of its position: WTO members may resort to Article 5.7 of the SPS Agreement¹¹² to address such concerns (although questions remain about the heightened and arguably equally insurmountable hurdles there) and any other interpretation would open the system up to abuse, which in turn could pose a more systemic risk for SPS disciplines as it will almost invariably be possible to find a scientist to argue a particular point.

2. Implementation Stage: Putting Risk Assessment into Action

Given that the AB has consistently held that there is no distinction between risk assessment and risk management, there remain nevertheless questions over the implementation of the results of the—textually required—risk assessment. According to the AB this means that there must be an “objective relationship”¹¹³ between the SPS measure and the risk assessment it is “based on.” Unlike the Panel, which had interpreted the wording “based on” as having to conform to the results of the risk assessment,¹¹⁴ the AB sees the requirements of this language as fulfilled when a measure is “sufficiently warrant[ed]” by the risk assessment.¹¹⁵ The result is a requirement in which the AB demands a rational relationship between the risk assessment and the SPS measure.¹¹⁶ The SPS Agreement allows WTO members to choose their appropriate level of protection¹¹⁷ in its territory, regardless of whether such a measure leads to inefficiencies in international trade.¹¹⁸ The ability of a WTO member to rely on minority views in the process of assessing the risk further allows for considerable policy discretion.

It is important to realize that the implementation is subject to a number of significant caveats. First, trade measures should be designed to minimize trade effects under Article 5.4, again

112. See *infra* Part III.D.

113. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 189.

114. See Panel Report, *US–Continued Suspension*, *supra* note 31, ¶ 8.137; Panel Report, *EC–Hormones (Canada)*, *supra* note 37, ¶ 8.140.

115. See Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 193.

116. See Appellate Body Report, *Japan–Agricultural Products II*, *supra* note 37, ¶ 79.

117. See SPS Agreement, *supra* note 5, Annex A, ¶ 5.

118. VAN DEN BOSSCHE, *supra* note 29, at 858.

indicating the discretion of WTO members by employing the term “should” instead of “shall” or “must.”¹¹⁹ In addition, the SPS Agreement provides for the principles of non-discrimination and proportionality.¹²⁰ Both of these principles are arguably made effective in a moderate form, that is, it may not be possible for a member to achieve absolute consistency in the application of SPS measures when risks have to be combated expeditiously.¹²¹ Further, the measure that a WTO member wishes to take must meet a form of proportionality testing, that is, measures that are reasonably available achieve the member’s chosen level of protection and which are significantly less trade restrictive than the contested measure.¹²²

As pointed out before, it is unclear to what extent non-scientific factors may be taken into account in implementing the results of the risk assessment. The issue does not only arise in the case law,¹²³ but has attracted considerable academic commentary due to its contested nature. Without repeating the arguments,¹²⁴ the debate surrounding this issue has an impact on the question at hand. Suffice it to say at this point that the impetus for some of the authors is neither the efficacy of scientific inquiry or the extent to which actual conclusions can be drawn, nor of how law and science interact. Their starting point may be that “the SPS Agreement was not drafted with the intent of being an *environmental* treaty”¹²⁵ or one in which economic efficiency is viewed as superior to other—even potentially legitimate—concerns.¹²⁶

The AB has indicated in its *EC-Hormones* decision that it takes a broader view by indicating that the “available scientific

119. SPS Agreement, *supra* note 5, art. 5.4.

120. See SPS Agreement, *supra* note 5, arts. 5.5, 5.6.

121. See Appellate Body Report, *EC-Hormones*, *supra* note 37, ¶ 213.

122. See Appellate Body Report, *Australia-Salmon*, *supra* note 37, ¶ 194.

123. See Panel Report, *EC-Hormones*, *supra* note 10, ¶ 8.105; Panel Report, *EC-Hormones (Canada)*, *supra* note 37, ¶ 8.108.

124. For an overview of the literature, see generally Warren Maruyama, *A New Pillar of the WTO: Sound Science*, 32 INT’L L. 651 (1998); Arcuri, *supra* note 85; Quick & Blüthner, *supra* note 81; Winickoff et al., *supra* note 85; Regine Neugebauer, *Fine-Tuning WTO Jurisprudence and the SPS Agreement: Lessons from the Beef Hormone Case*, 31 LAW & POL’Y INT’L BUS. 1255 (2000). See also EDITH BROWN WEISS ET AL., *RECONCILING ENVIRONMENT AND TRADE* (2d ed. 2008).

125. Neugebauer, *supra* note 124, at 1256.

126. See generally Quick & Blüthner, *supra* note 81.

evidence” is only a starting point and that the list in Article 5.2 is not a closed one.¹²⁷ Its famous invocation of “the real world where people live and work and die”¹²⁸ shows that it is at the very least cognizant that there may be other factors that can have an impact on governmental decision-making.

D. *The Meaning of Scientific Uncertainty and the (In)Sufficiency of Scientific Evidence*

The SPS Agreement recognizes that there may be instances in which sufficient scientific evidence is not available at a particular moment in time, yet nevertheless a WTO member, having set its own “appropriate level of risk” as low (or zero), concludes that there is a particular risk it wants to guard against. In such a situation, Article 5.7 operates as a “qualified exemption” to certain provisions of the SPS Agreement.¹²⁹ While the precautionary principle may be “reflected” in Article 5.7, the provision does not serve as a ground for justifying otherwise WTO-inconsistent measures.¹³⁰ Thus, under the circumstances laid out in Article 5.7, a WTO member may deviate from the disciplines of Articles 2.2 and 5.1 through 5.3. This reading leaves requirements such as non-discrimination and proportionality intact.¹³¹

The preconditions for Article 5.7 are fourfold, the first two of which must be met before the adoption of a provisional measure, the latter two in order to maintain the provisional measures. There must be: (1) insufficient scientific evidence; (2) the measure is “adopted on the basis of available pertinent information;” (3) a WTO member invoking this provision must seek additional scientific information; and (4) the measure is subject to review within a “reasonable period of time.”¹³²

Provisional measures can thus only be put in place where there is, at the very least, some indication that a risk exists that may come to fruition. It is equally clear that the risk may never

127. See Appellate Body Report, *EC-Hormones*, *supra* note 37, ¶ 187.

128. *See id.*

129. See Panel Report, *Japan Agricultural Products II*, *supra* note 37, ¶ 80.

130. See Appellate Body Report, *EC-Hormones*, *supra* note 37, ¶ 124.

131. See SPS Agreement, *supra* note 5, arts. 5.5, 5.6.

132. See Appellate Body Report, *Japan-Agricultural Products II*, *supra* note 37, ¶ 89 (quoting SPS Agreement, *supra* note 5, art. 5.7).

materialize. That being said, Article 5.7 mandates that scientific evidence be “insufficient” and therefore neither covers situations in which there is scientific uncertainty as to the risk a member alleges,¹³³ nor situations in which there is sufficient evidence to carry out a risk assessment.¹³⁴ Rather, the rationale of Article 5.7 is to provide WTO Members with temporary respite from the SPS disciplines, provided that measures are maintained on a permanent basis only when sufficient scientific evidence can be provided.

The AB addressed the question of insufficiency in *Japan–Measures Affecting the Importation of Apples*, when it found that such a state exists when “the body of available scientific evidence does not allow, in quantitative or qualitative terms, the performance of an adequate assessment of risks.”¹³⁵ In *US–Continued Suspension*, the AB further elaborated on this requirement, clarifying that as long as there is a “qualified and respected scientific view that puts into question the relationship between the relevant scientific evidence and the conclusions in relation to risk, thereby not permitting the performance of a sufficiently objective assessment of risk on the basis of the existing scientific evidence,”¹³⁶ WTO members may rely on such a point of view. This does not require the meeting of a “critical mass” standard that “call[s] into question the fundamental precepts of previous knowledge and evidence so as to make relevant, previously sufficient, evidence now insufficient,” as the Panel in *US–Continued Suspension* demanded.¹³⁷ The AB rightly characterized such a requirement as a “paradigm shift,” that would be too high a threshold for the applicability of Article 5.7, pointing out that such fundamental shifts occur rather infrequently.¹³⁸ The Panel’s approach may also be called into

133. Panel Report, *Japan–Apples*, *supra* note 37, ¶ 184.

134. See Peter-Tobias Stoll & Lutz Strack, *Article 5 SPS*, in 3 MAX PLANCK COMMENTARIES ON WORLD TRADE LAW: WTO—TECHNICAL BARRIERS AND SPS MEASURES, ¶ 78–79 (Rüdiger Wolfrum et al. eds., 2007). A similar rationale was proffered by the panel in the Panel Report, *EC–Approval and Marketing of Biotech Products*, *supra* note 11, ¶ 7.2992.

135. Appellate Body Report, *Japan–Apples*, *supra* note 37, ¶ 179; see Appellate Body Report, *US–Continued Suspension*, *supra* note 37, ¶ 674.

136. Appellate Body Report, *US–Continued Suspension*, *supra* note 37, ¶ 677.

137. *Id.* ¶ 7.648.

138. *Id.* ¶¶ 703–05.

question on a more fundamental level. Requiring that “the new scientific information and evidence must be such that they are *at the origin* of a change in the understanding of a scientific issue,”¹³⁹ displays that the Panel did not understand the foundation of scientific exploration. It is simply impossible to know “*at the origin*” whether such a change will in fact take place. It is precisely the role of provisional—or precautionary—measures to determine this in light of potentially irreversible consequences. Thus, it is important—and the AB recognizes this—that a WTO member be able to point to deficiencies in the body of scientific evidence that call into question the drawing of objective conclusions.

It should be noted moreover that the very term “insufficiency” is not amenable to a singular interpretation and may very well be context-dependent. This became evident in the panel report in *EC-Approval and Marketing of Biotech Products*, when one of the experts described the situation in which national regulators may find themselves when having to choose between expediency and greater certainty. As the Panel pointed out: “[i]t is not always clear where the distinction lies between what regulators ‘need to know’ *vs.* what is merely ‘nice to know.’”¹⁴⁰

Any measure must be taken “on the basis of available pertinent information.”¹⁴¹ The choice of “pertinent information” instead of “scientific evidence” already indicates that a member may use a broader set of sources than would be available under the requirements for a risk assessment set forth in Article 5.1. Clearly, the information “must be germane to conducting such a risk assessment.”¹⁴² As is the case in Article 5.1, this information does not have to originate from the member, but can be taken from other members or international organizations. This requirement, however, serves to provide a “rational and objective relationship” between the risk that a

139. Panel Report, *US-Continued Suspension*, *supra* note 37, ¶ 6.141.

140. Panel Report, *EC-Approval and Marketing of Biotech Products*, *supra* note 11, Annex H, ¶ 14.

141. SPS Agreement, *supra* note 5, art. 5.7.

142. Appellate Body Report, *Japan-Agricultural Products II*, *supra* note 37, ¶ 92.

member identifies and the provisional measure it wants to employ.¹⁴³

Once a provisional measure is in place, a WTO member invoking this provision must seek additional information in order to conduct an objective risk assessment within a “reasonable period of time.”¹⁴⁴ It is therefore obliged to actively seek additional information to make up for the informational deficit that has led to the institution of the provisional measure in the first place and to review its measures on a periodic basis in light of the information available—ultimately leading to a member having to repeal a measure if no additional and “better” information can be found to support the imposition of the measure in question through the risk assessment process.¹⁴⁵ One of the questions that necessarily arises from these requirements is the nature and quality of the “additional information” that is to be obtained. The sole requirement appears to be that a member “seek[s] to obtain” more information.¹⁴⁶ In *EC–Hormones*, the AB appeared to require a kind of roadmap in which the insufficiencies in the relevant scientific evidence are identified and how this insufficiency may be overcome.¹⁴⁷ These requirements appear uncontroversial. The AB requires governments to show that they continue to pursue information—ultimately in the form of scientific evidence—of a risk which they consider to be serious enough to deviate from the requirements of Articles 2.2 and 5.1 of the SPS Agreement.

The reasonable amount of time given to WTO members depends on the case at hand, so that bright line rules have not been established. The AB was cognizant of the complex interplay of the cases that may arise when it pointed out that the specific circumstances of each case and the difficulty to obtain

143. Appellate Body Report, *US–Continued Suspension*, *supra* note 37, ¶ 678.

144. SPS Agreement, *supra* note 5, art. 5.7.

145. For a different view, arguing that Article 5.7 should be seen as an independent right leading to a continuous requirement for research, see Andrew T.F. Lang, *Provisional Measures under Article 5.7 of the WTO’s Agreement on Sanitary and Phytosanitary Measures: Some Criticisms of the Jurisprudence So Far*, 42 J. WORLD TRADE 1085, 1091–95 (2008).

146. Appellate Body Report, *Japan–Agricultural Products II*, *supra* note 37, ¶ 92.

147. See Appellate Body Report, *US–Continued Suspension*, *supra* note 37, ¶ 124.

additional information may differ from case to case.¹⁴⁸ This may mean that, depending on the gravity of the risk at hand, a provisional measure may be sustained for a prolonged period of time, whereas this may not be the case for situations in which the potential for harm is negligible.¹⁴⁹ The AB's position is in line with its previous jurisprudence that gave governments considerable—though not unfettered—discretion when deciding whether to resort to precautionary and provisional measures when there is insufficient information to conduct a risk assessment.

III. *RISK AS A SCIENTIFIC UNDERTAKING: TRANSFORMING SCIENCE INTO LEGAL CATEGORIES*

This section addresses the question of how to “translate” or integrate the results of scientific inquiries into legal decisions. As shown above, the processes, procedures, and underlying philosophies of law and science differ considerably. At the same time, the SPS Agreement shows that science plays a pivotal role in the dispute settlement process concerning SPS measures. This is not a question that is confined to the realm of WTO law, but rather touches a large variety of areas in which law considers scientific conclusions. These conclusions may not be fully determinative, but at the very least highly indicative. This may be said for such diverse fields as environmental law, criminal law (e.g., DNA evidence), as well as tort law.¹⁵⁰

There are a number of schools of thought that have addressed this question, which is undergoing growth and complexity as scientific insight increases.¹⁵¹ It is also a field that

148. Appellate Body Report, *Japan–Agricultural Products II*, *supra* note 37, ¶ 93.

149. The AB's flexibility regarding provisional measures can be contrasted with the Panel's stricter approach. *See, e.g.*, Appellate Body Report, *Australia–Salmon*, *supra* note 37, ¶ 8.57 (finding a measure imposed over twenty years ago “can thus hardly be seen as a measure ‘provisionally’ adopted”).

150. *See Monsanto Co. v. Geertson Seed Farms*, 130 S. Ct. 2743, 2758 (2010) (detailing proceedings in which both parties in environmental litigation relied upon scientific experts with wildly different conclusions based on the same material); *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 588 (1993) (relying on scientific expert testimony in tort); *United States v. Sullivan*, 246 F. Supp. 2d 700, 702–03 (E.D. Ky. 2003) (relying on scientific expert testimony in a criminal prosecution).

151. For early attempts at delineation, see generally K.S. SHRADER-FRECHETTE, *RISK AND RATIONALITY: PHILOSOPHICAL FOUNDATIONS FOR POPULIST REFORMS* (1991); Susanna Hornig, *Reading Risk: Public Response to Print Media Accounts of Technological*

draws expertise from a large variety of other disciplines: science; science studies; economics; political science; sociology; humanities; ethics; psychology; and law. There are schools of thought that are based on rational choice scholarship, though their views on how legal conclusions can be based on scientific results varies considerably, and therefore it appears impossible to describe these schools of thought under one single rubric. Others schools of thought consider rational choice scholarship—by its nature—to be incomplete, and prefer, in situations of evidentiary insufficiency, to rely on the precautionary principle.¹⁵² Moreover, and partially overlapping, social science scholars have pointed out the need to take non-scientific elements into consideration to a considerable extent when making potentially far-reaching decisions concerning the permissibility of governmental measures.

It is self-explanatory that the delineation between these different schools of thought offered below is open to debate and that there exists considerable overlap between some of the approaches outlined below. Nevertheless, the categorization is designed to illuminate the differing approaches that can be brought to bear on this question—both generally when law and science interact, but also more specifically with respect to WTO law. Before turning to a description of these transmission models, it is helpful to briefly outline the concept of risk, what is understood by the term, how its extent can be determined, and what may lead to uncertainties about its extent.¹⁵³

A. *What is Risk?*

Risk has historically been a subject of considerable interest, first developing in areas such as investment and gambling—areas in which the participants have a great interest to

Risk, 2 PUB. UNDERSTANDING SCI. 95 (1993); see also Paul B. Thompson & Wesley Dean, *Competing Conceptions of Risk*, 7 RISK 361, 365–66 (1996). For early legal approaches, see generally PETER ASCH, CONSUMER SAFETY REGULATION: PUTTING A PRICE ON LIFE AND LIMB (1988). In the WTO context, see Arcuri, *supra* note 85, at 209–12, distinguishing between groups that follow a quantitative-risk logic and a holistic-group logic.

152. ROBERT N. BELLAH ET AL., THE GOOD SOCIETY 122 (1992) (quoting a US government agent describing cost-benefit analysis as “ignor[ing] whatever risks can’t be measured”).

153. For an example of one of the myriad of definitions (of the conceptions) of risk, see Thompson & Dean, *supra* note 151, at 365.

determine the payoff for a particular decision they are making.¹⁵⁴ This approach to determining the potential negative impacts of any course of action was subsequently taken up by other fields such as insurance and engineering, each developing its own inquiries into how to understand risk.¹⁵⁵ What has emerged is a general understanding of risk that includes certain elements. This includes the likelihood of a particular risk multiplied by the gravity of the harm that would result. The resulting overall factor of risk is a probabilistic determination of a risk coming to fruition, involving a certain magnitude.¹⁵⁶ This very thin description of the concept of risk does not contain all the elements that traditionally enter a risk determination. In addition, and especially in the natural sciences, factors such as variability and uncertainty play a role. The former is a testament to the fact that the responses individuals have to the exposure to an agent are different. The latter is recognition of the incompleteness of scientific data, which can stem from the existence of competing datasets, lack of perfect data, or competing theories of what conclusions are to be drawn from a dataset.¹⁵⁷

The result is usually a statement from scientific experts as to the existence and magnitude of risk, containing the following criteria: exposure to a particular agent involves the probability of adverse effects; these effects are variable depending on the individual who is exposed to the agent and will be given on a scale of probability including built-in buffers accounting for the uncertainty in determining the probability.¹⁵⁸ This is the result of how science works, an aspect often misunderstood by non-

154. See Ronald N. Giere, *Knowledge, Values, and Technological Decisions: A Decision Theoretic Approach*, in *ACCEPTABLE EVIDENCE: SCIENCE AND VALUES IN RISK MANAGEMENT* 183, 183 (Deborah G. Mayo & Rachele D. Hollander eds., 1991) (describing how decisions about new technology moved from the private sphere to become increasingly public after World War II); PETER L. BERNSTEIN, *AGAINST THE GODS: THE REMARKABLE STORY OF RISK* 1–6 (1996).

155. Chauncey Starr, *Social Benefit versus Technological Risk*, 165 *SCIENCE* 1232, 1232 (1969); J.D. HAMMOND, *ESSAYS IN THE THEORY OF RISK AND INSURANCE*, preface (1968).

156. See CRAWFORD-BROWN, *supra* note 38, at 5. Note that there is an important distinction to instances when an event is certain to occur, in which case one uses the term consequences rather than risk.

157. Crawford-Brown et al., *supra* note 13, at 463.

158. *Id.*

scientists (including lawyers, judges and adjudicators): science is able to explain causal relations with a great deal of accuracy only in relatively simple analyses. The more variables a system has and thus the higher the degree of complexity (e.g., nuclear power plants or climate change), the more challenging if not impossible it is to prove with a high degree of certainty what is to be assessed. Any attempt at translating the results of this “view through a blurry window at the truth” must reconcile with this obstacle.¹⁵⁹ It remains a matter of considerable debate whether non-scientific elements enter the determination of whether a risk exists,¹⁶⁰ a question that is also dependent on whether the participants in the debate are experts or ordinary persons.¹⁶¹

B. Rational Choice Models

At one end of the spectrum are those that promote a purely probabilistic determination of risk and do not take into account the potential consequences that may arise. It is only a theoretical model and the view, in its pure form, is generally not held by authors. However, there are proponents of models whose own understanding is largely aligned with a considerable portion of this understanding of risk, while others prefer a more holistic rational choice model.

1. Probabilistic Models

Strong forms of risk determination rely on probabilistic methods which rely on quantitative analysis to arrive at an assessment of a particular risk. A classic example of this understanding is Chauncey Starr's and Chris Whipple's “*Risks of*

159. John D. Graham & Lorenz Rhomberg, *How Risks Are Identified and Assessed*, 545 ANNALS AM. ACAD. POL. & SOC. SCI. 15, 19 (1996).

160. See *infra* Part V.

161. Note the debate surrounding risk assessment is carried out by experts and by the public, with sometimes fundamental differences. See Slovic, *supra* note 4, at 281 (providing empirical evidence for the different perceptions of risk by experts and the public); Roger E. Kasperson & Jeanne X. Kasperson, *The Social Amplification and Attenuation of Risk*, 545 ANNALS AM. ACAD. POL. & SOC. SCI. 95, 101 (1996) (noting the effect of ordinary people's social amplification of risk). See generally Ann Bostrom, *Risk Perceptions: “Experts” vs. “Lay People,”* 8 DUKE ENVTL. L. & POL'Y F. 101 (1997); HOWARD MARGOLIS, DEALING WITH RISK: WHY THE PUBLIC AND THE EXPERTS DISAGREE ON ENVIRONMENTAL ISSUES (1996).

Risk Decisions."¹⁶² The core of their argument is that analysis is "a process based on collected data, anecdotal cases, and statistics, any of which may or may not be correct; and, based on these, we invent simplified models to predict an outcome."¹⁶³ This projected outcome contains, as the authors admit, "a large uncertainty in the predictions," yet they feel that their model is superior because of the importance of "improv[ing] the quality of decision-making."¹⁶⁴

The role of risk analysis is not to be conflated with the role that decision-makers fulfill. However, the latter's role must take into account intangible costs, but for whom proper risk assessment is essential. Difficulties exist in measuring these intangible costs, that may differ depending on who is being interrogated. This leads the representatives of this approach to not conduct an investigation into what they call the intuitive risk assessment involving perceptions about a risk (such as the dangers emanating from nuclear power plants), rather than scientific, probabilistic data.¹⁶⁵

2. Rational Choice Theory Meets Law: Law and Economics

Various iterations of rational choice theory have found their way into the legal academy. Concerned with law's reliance on intuitions about fairness and justice and—at least from today's perspective—based on Ronald Coase's highly influential 1960 article "*The Problem of Social Cost*,"¹⁶⁶ a remarkably influential school of thought has emerged, especially in the United States.¹⁶⁷ The proliferation of the rational choice theory, first developed in economics, has necessarily produced a large

162. Chauncey Starr & Chris Whipple, *Risks of Risk-Decisions*, 208 *SCIENCE* 1114 (1980).

163. *Id.* at 1115. For an institutionalized approach, proposing a "science court," see generally Arthur Kantrowitz, *Proposal for an Institution for Scientific Judgment*, 156 *SCIENCE* 763 (1967).

164. Starr & Whipple, *supra* note 162, at 1115.

165. *See id.* at 1116.

166. *See generally* R.H. Coase, *The Problem of Social Cost*, 3 *J.L. & ECON.* 1 (1960). Other early influential works include RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* (4th ed. 1992); Gary S. Becker, *Crime and Punishment: An Economic Approach*, 76 *J. POL. ECON.* 169 (1968); Richard Epstein, *Law and Economics: Its Glorious Past and Cloudy Future*, 54 *U. CHI. L. REV.* 1167 (1997).

167. For a brief history, see Epstein, *supra* note 166, at 1168.

number of subfields in legal academia and has sparked considerable revisions of the original model.¹⁶⁸ At its core lies the inquiry of what choice a rational person will make given certain preferences. Because of the prevalence of rational choice theory in the fields of economics, sociology, political science, and law, the theory has had considerable influence not only in the way academics think about problems, but also in the policy field.¹⁶⁹ In an informal way, rational choice theory posits that individual or group choice must be deliberative and consistent.¹⁷⁰ The premise for this view is a reasoned justification, providing the rationale for the choice made. Moreover, on the basis of this reasoning, it can be expected that the choice does not change inexplicably and the means chosen for the attainment of the goals pursued are reasonably well-suited.¹⁷¹ More convincing is the approach that posits the transitive nature of consumers' preferences who seek to maximize the utility derived from such preferences. The origins of the theory explained consumer decisions, which are, to a large degree, quantifiable. Inherent in this approach is a reliance on empirical data on the basis of which decision making can be improved. Thus, when evaluating risk, rational choice theory, at least in the past, has encouraged the collection and subsequent dissemination of information so that "correct" decisions may be made. The advantage of this approach is, naturally similar to the previous model, that its results yield empirically confirmed predictions.

Although these observations apply as much to the purely probabilistic school of thought outlined above, there are important objections that can be raised both with respect to this model as well as the previous one. For example, the market choices that the model was invented for are frequent and routine (such as purchasing toothpaste), whereas a decision over whom to marry or whether to permit hormone-treated beef to be imported into a WTO member's territory is one of more

168. See, e.g., Amos Tversky & Daniel Kahneman, *Rational Choice and the Framing of Decisions*, in DECISION MAKING: DESCRIPTIVE, NORMATIVE, AND PRESCRIPTIVE INTERACTIONS 167, 167 (David E. Bell et al. eds., 1988).

169. Thomas S. Ulen, *Rational Choice and the Economic Analysis of the Law*, 19 LAW & SOC. Y INQUIRY 487, 49 (1994).

170. *Id.* 791-92.

171. See generally ROBERT NOZICK, THE NATURE OF RATIONALITY (1993).

general applicability; prices for products are comparable as the market reflects consumer preferences through a specific price point, whereas it is more difficult to determine the price for intangible goods that can be valued differently by individuals. Finally, it is difficult to determine the optimal decision when non-market choices are involved and there may simply not be a correct choice; in these cases it may not be transparent what has led to a particular choice.¹⁷²

In the case of uncertainty or insufficiency of information, rational choice theory may not provide adequate prediction models either. As is the case in the natural sciences, the more complex a problem and the more variables involved, the less potent rational choice theory is. While purporting to avoid the biases that are inherent in decision making, rational choice theory's starting point is what opens the approach to criticism. It presupposes unbiased decision making because of unbounded rationality and unbounded self-interest.

3. Behavioral Economics, or: Cognitive Psychology

Distinct from the representatives of law and economics just outlined are those, that while building on and refining the previous model,¹⁷³ favor behavioral economics as a basis for decision making. Positing that the model of *homo economicus* is incomplete in that it ignores the contributions of cognitive and social psychologists, this approach places a higher emphasis on social, cognitive, and even emotional factors than does rational choice theory.¹⁷⁴ It has also spawned a considerable amount of literature on the question of how to deal with risk and uncertainty.¹⁷⁵ By and large, this literature has focused on how

172. Thomas S. Ulen, *The Growing Pains of Behavioral Law and Economics*, 51 *VAND. L. REV.* 1747, 1759 (1998).

173. *Id.* at 1748. Indeed, one of the most prominent representatives of rational choice theory has assumed the post of Head of the Office of Information and Regulatory Affairs at the White House, which reviews regulations under cost-benefit considerations. See Benjamin Wallace-Wells, *Cass Sunstein Wants to Nudge Us*, *N.Y. TIMES*, May 16, 2010 (Magazine), at 38.

174. Ulen, *supra* note 172, at 1748.

175. See, e.g., Amos Tversky & Daniel Kahneman, *Judgment under Uncertainty: Heuristics and Biases*, 185 *SCIENCE* 1124, 1124, 1131 (1974); Steven L. Schwarcz, *Systemic Risk*, 97 *GEO. L.J.* 193 (2008); Vern R. Walker, *Risk: Health, Safety & Environment*, 9 *RISK* 27 (1998).

individuals make decisions through the use of simplifying heuristics or shortcuts designed to make complex decisions simpler and more manageable.¹⁷⁶ Such shortcuts are useful, as otherwise individuals would be overburdened by having to carefully analyze probabilities for every decision that they make throughout the day.¹⁷⁷ However, in highly complex situations, these heuristics are inadequate to fully assess the risk that confronts an individual or society.¹⁷⁸

A concise version of this view can be described as follows: the availability of a danger in an individual's mind may bring particular and familiar risks to mind at the expense of other, more salient ones (the availability heuristic); individuals often neglect risks that are highly salient in exchange for focusing on the worst case scenario (probability neglect); individuals are averse to change in the *status quo* (loss aversion); human-induced risks are more suspect than the risks produced by nature (benevolence of nature); and people do not recognize secondary effects or risks that are not directly related to their own activity (system neglect).¹⁷⁹ In this version of behavioral economics, rather than basing decisions on the precautionary principle, complex decisions are based on a narrow anti-catastrophe principle, which is moderated by a cost-benefit analysis.¹⁸⁰ This in turn may lead to a decision-making process that Cass Sunstein calls "libertarian paternalism."¹⁸¹

There are a number of principled objections to this approach.¹⁸² The "anti-catastrophe principle" that is brought to bear against the precautionary principle requires the

176. See, e.g., Gregory N. Mandel, *Technology Wars: The Failure of Democratic Discourse*, 11 MICH. TELECOMM. & TECH. L. REV. 117, 158 (2005).

177. *Id.*

178. *See id.*

179. CASS R. SUNSTEIN, LAWS OF FEAR: BEYOND THE PRECAUTIONARY PRINCIPLE 35-49 (2005).

180. *Id.* at 114.

181. *Id.* at 176. Sunstein understands the concept of "libertarian paternalism" to be an approach through which welfare is promoted while maintaining an individual's ability to largely choose their own actions. A more detailed defense of this concept can be found in Cass R. Sunstein & Richard Thaler, *Libertarian Paternalism Is Not an Oxymoron*, 70 U. CHI. L. REV. 1159 (2003).

182. See DOUGLAS A. KYSAR, REGULATING FROM NOWHERE: ENVIRONMENTAL LAW AND THE SEARCH FOR OBJECTIVITY 71, 1-22 (2010). The author presents an excellent criticism of what is seen by some scholars as an overreliance on cost-benefit analysis in risk assessment.

identification of all risks that a certain action may entail against the risk of inaction.¹⁸³ The ability to assess these risks suffers from the same limitations as other approaches in that science may not be able to provide sufficient data to make an informed decision. Furthermore, the principle would not apply to situations where costs are high (for example climate change),¹⁸⁴ thereby rendering the principle inoperative in the situations that adjudicatory bodies often face. The same applies to the modified cost-benefit analysis that forms part of this analysis.¹⁸⁵ While the results of this analysis are not determinative—a departure from previously described versions of this more general school of thought—it remains unclear how precise the data for such an assessment can be.¹⁸⁶ Sunstein's proposed use of willingness-to-pay is an attempt to better demarcate the costs, but it is just as subjective and problematic at providing a value for harm that is spatially and temporally removed. An example of this would be climate change or any other complex problem the effects of which may only materialize after the passage of considerable time.

C. Precaution-Based Jurisprudence

A further step away from probability-based approaches is what may be termed precaution-based jurisprudence. The debate about the salience of the precautionary principle is an arduous one—this is not the place to describe it or the history of the precautionary principle in great detail.¹⁸⁷ Suffice it to say that the debate has yielded a plethora of versions of the precautionary principle. On the one end of the spectrum are those who favor banning all technology that poses a potential negative health or environmental impact, even in situations where the probability of harm cannot be ascertained. On the

183. SUNSTEIN, *supra* note 179, at 113.

184. *Id.* at 113–15.

185. *Id.* at 129–32.

186. For a critique focusing on the problem of disentangling values and facts, see Susan A. Bandes, *Emotions, Values, and the Construction of Risk*, 156 U. PA. L. REV. PENNUMBRA 421, 427 (2008).

187. For more information on this topic, see generally Jaye Ellis, 'Overexploitation' of a Valuable Resource? *New Literature on the Precautionary Principle*, 17 EUR. J. INT'L L. 445 (2007).

other end are those who argue against too prevalent a use of the precautionary principle as it may prevent innovation.¹⁸⁸

The more serious versions of the precautionary principle recognize the importance of scientific evidence at its core, but also take seriously that science has inherent limitations in what evidence it is capable of providing.¹⁸⁹ This requires a careful delineation of the core elements of the precautionary principle. Otherwise, there is a considerable danger of arbitrary invocation of the precautionary principle by domestic governments.¹⁹⁰ The situations in which the precautionary principle finds application are characterized by: (1) uncertainty about the occurrence of harm, especially in highly complex matters; (2) uncertainty about the risks of human behavior; and (3) the ability of governments to take action in the face of such uncertainties.¹⁹¹ One feature of the precautionary principle is an inherent element of flexibility. It does not dictate a specific regulatory measure, but rather allows for a variety of measures to be taken by domestic governments. While it can support measures to protect the public from environmental and health risks, the precautionary principle is constrained by the requirements of proportionality, nondiscrimination, consistency, and a (not necessarily economic)¹⁹² cost-benefit analysis. Importantly, precautionary principle statements often contain a verification element, that is, an obligation to further consider the situation that has triggered the reliance on the precautionary principle in the first place.

The legal status of the precautionary principle remains unclear at this point, although it has been a contentious issue in WTO jurisprudence. The most that the AB has said so far is that

188. *Id.*

189. JACQUELINE PEEL, *THE PRECAUTIONARY PRINCIPLE IN PRACTICE: ENVIRONMENTAL DECISION-MAKING AND SCIENTIFIC UNCERTAINTY* 21–22 (2005). Some of the proponents of behavioral science do not shun the precautionary principle in its entirety, but do support a weak version of the precautionary principle. *See, e.g.*, SUNSTEIN, *supra* note 179, at 117–22.

190. For an example of this tension, see Annecoos Wiersema, *Adversaries or Partners? Science and the Precautionary Principle in International Wildlife Treaty Regimes*, 11 J. INT'L WILDLIFE L. & POL'Y 211 (2008)

191. Arie Trouwborst, *The Precautionary Principle in General International Law: Combating the Babylonian Confusion*, 16 REV. EUR. COMMUNITY INT'L EVTL. L. 185 (2007).

192. *See* Commission Communication on the Precautionary Principle, COM (2000) 1, ¶ 6(3).

the precautionary principle finds reflection in various provisions of the SPS Agreement and that, especially in cases where risks may be irreversible, “responsible, representative governments commonly act from perspectives of prudence and precaution.”¹⁹³ Similar to other international bodies,¹⁹⁴ the AB did not pronounce that the precautionary principle was a legal concept of universal application in international law.¹⁹⁵

In the WTO context, the precautionary principle has been most forcefully defended by the EC in cases concerning hormone-treated beef and the potential dangers of genetically modified organisms in food. The underlying idea for the use of the precautionary principle is that in the absence of scientific evidence linking growth hormones to the development of cancer in consumers, the EC was nevertheless basing its decision to ban meat treated with particular hormones on indications that such a risk existed.

D. *Risk Assessment as a Value-Dependent Exercise*

Finally, another school has emerged that emphasizes the importance of including social and cultural values in the risk assessment procedure. This approach has been discussed in more general terms for some time now¹⁹⁶ and has received considerable attention in the WTO context.¹⁹⁷ This school of thought argues that expert judgments are under particular scrutiny the more an issue is in the public eye.¹⁹⁸ This may lead to unconscious influence on experts due to “pre-existing policy preferences,” media representations, or the mere exposure to

193. Appellate Body Report, *US–Continued Suspension*, *supra* note 37, ¶ 124.

194. *See, e.g.*, The MOX Plant Case (Ir. v. U.K.), Case No. 10, Order of Dec. 3, 2001, ¶ 75, http://www.itlos.org/fileadmin/itlos/documents/cases/case_no_10/Order.03.12.01.E.pdf.

195. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 123. The AB found it “unnecessary, and probably imprudent . . . to take a position on this important, but abstract, question.” *Id.*

196. *See generally* Thompson & Dean, *supra* note 151; Kasperson & Kasperson, *supra* note 161; Alonzo Plough & Sheldon Krinsky, *The Emergence of Risk Communication Studies: Social and Political Context*, 12 *SCI. TECH. & HUMAN VALUES* 4 (1987).

197. *See generally* Winickoff et al., *supra* note 85; Foster, *supra* note 85; Lang, *supra* note 145; Epps, *supra* note 85.

198. *See* Winickoff et al., *supra* note 85, at 99. *See generally* Ellis, *supra* note 187.

colleagues who may influence an individual's risk perception.¹⁹⁹ Where stakes are higher, this issue is of even more concern: nuclear power is often cited as an example where cognitive dissonance is at its most visible, or at least all but unavoidable.²⁰⁰ This is especially so in the context of what Alvin Weinberg calls "trans-science:" situations in which science may be able to ask the questions, but is unable to provide the answers because they involve the resolution of social problems that are not amenable to resolution through the procedures science has at its disposal.²⁰¹

In the context of the WTO this has led some authors to conclude that in the face of scientific uncertainty, a "WTO Member should be able to defend sanitary or phytosanitary measures on the basis that its population simply does not want to run a given risk."²⁰² This view is premised on decisions being made in a responsible fashion by democratically elected governments and following a deliberative process.²⁰³ Despite recognizing the potential for abuse, the majority of the proponents of this view remain committed to the idea that inherent elements of democracy justify this approach.²⁰⁴

For one, some authors believe that social science research may mitigate unavoidable perception problems that may arise because of the politicization of issues, the potential disadvantageous treatment that foreign products may receive over domestic products purely on the basis of their foreign origin in governmental discourse, as well as the almost inevitable media bias that may arise in such situations.²⁰⁵ These objections

199. Harvey Brooks, *The Resolution of Technically Intensive Public Policy Disputes*, 9 SCI. TECH. & HUMAN VALUES 39, 40 (1984).

200. See, e.g., Winickoff et al., *supra* note 85, at 97; Alvin M. Weinberg, *Science and Its Limits: The Regulator's Dilemma*, in DE MINIMIS RISK 27, 27-38 (Chris Whipple ed., 1987).

201. See generally Alvin M. Weinberg, *Science and Trans-Science*, 10 MINERVA 209 (1979).

202. Foster, *supra* note 85, at 432.

203. See generally Howse, *supra* note 88, at 2340-43. As Howse points out, the central contribution of science under this view is that it contributes to democratic rationality in the risk assessment. *Id.*; see also Walker, *supra* note 85, at 197; cf. ROBIN FELDMAN, *THE ROLE OF SCIENCE IN LAW* 157 (2009).

204. See Winickoff et al., *supra* note 85, at 85, 99, 122-23.

205. See Joanne Scott & Ellen Vos, *The Juridification of Uncertainty: Observations on the Ambivalence of the Precautionary Principle within the EU and the WTO*, in GOOD GOVERNANCE IN EUROPE'S INTEGRATED MARKET 253, 285-86 (Christian Joerges &

are countered with the importance of human life and health that may be at stake and are ameliorated with the requirement to show the proportionality of any measure in relation to the risk that a WTO member wishes to counter.²⁰⁶

Whether the lack of importance attached to public opinion in the case law so far results in this question being “an open one at present”²⁰⁷ is debatable. The AB’s comment that the world is not a laboratory, but rather a place where “people live and work and die” is cryptic at best and can be interpreted in a multitude of ways. Combined with the AB’s finding that the list of factors that may be taken into account in conducting a risk assessment under Article 5.2 of the SPS Agreement is not a closed one, the argument may be more powerful. But, at least to date, there is nothing in the case law to indicate that the dispute settlement organs are moving toward the inclusion of public opinion in assessing risk. Moreover, it may not always be clear whether governments use a genuine deliberative process in carrying out a risk assessment and the conditions under which a discourse takes place may already predicate the outcome.

E. Pure Contextualist Understanding of Risk

Less significant than the previous schools of thought is a purely contextualist understanding of risk that places equal importance on probability, voluntariness, and familiarity. This school of thought is more than just a step removed from a scientific understanding of risk. Rather, a host of attributes are taken into account, but none of them is considered essential; any one factor, including scientific evidence, may not play any role at all.²⁰⁸ According to this school of thought, risk may be equated with unfamiliarity and the language of risk used to express this sentiment with a particular product or process, because the use of a technology may not have been introduced

Renaud Dehousse eds., 2002); Caroline E. Foster, *Social Science Experts and Amicus Curiae Briefs in International Courts and Tribunals: The WTO Biotech Case*, 52 NETH. INT’L L. REV. 433, 449–53 (2005); Andrew Green & Tracey Epps, *The WTO, Science, and the Environment: Moving towards Consistency*, 10 J. INT’L ECON. L. 285, 304–05 (2007).

206. Foster, *supra* note 85, at 450.

207. *Id.* at 444.

208. See Thompson & Dean, *supra* note 151, at 369.

in this societal context.²⁰⁹ This may be the case in situations where there is no measurable harm at all, but rather the term risk is used in what one may call non-technical, conveying unfamiliarity with the practice or technology that is under consideration. Important for present purposes is that the proponents of this view believe that “cultural and experiential inputs” have equal importance compared to the probabilistic model, which they describe as “reductionist, focusing on quantifiable variables.”²¹⁰

F. *Summary*

It is clear that in the absence of clear scientific evidence, the results of the scientific inquiry must somehow be “translated” into the adjudicatory process. While risk assessment has inherent limitations, it has proven to be an indispensable tool in the decision-making process. It is capable of providing a more rational basis on which to make such decisions. Additionally, risk assessment provides the basis for administrative decision making in democratic states. When carried out responsibly, a risk assessment can respond to subsequent inquiry, it may be reviewed by others, and tested for accuracy. How such a translation is to take place depends largely on the importance of various factors, which, depending on one’s point of view, either form part of the risk assessment or should enter the process at a later stage. Different schools of thought hold divergent views on how to deal with scientific evidence that may not be sufficient. As has become clear, these transmission mechanisms exist on a continuum, ranging from purely probabilistic versions of risk assessment to those that are purely contextualist.

Scientific evidence provides clear answers in only the rarest of circumstances. Its proper role is best understood as an attempt to determine the probability of harm given a set of predetermined conditions. Moreover, and crucially, science does not address the acceptability of the risk that may exist. This is ultimately a question for policy-makers. The next section of this Article addresses the manner in which these decisions have

209. *See id.* at 374.

210. Plough & Krimsky, *supra* note 196, at 7.

been adjudicated in the context of the WTO and thus a pluralistic society.

IV. *WTO JURISPRUDENCE AND RISK: AN UNCOMFORTABLE RELATIONSHIP*

Panels and the AB have, at various times and in various compositions, had to handle questions of how and to what extent scientific evidence should be used in their decision-making processes. In the context of translating the results of scientific inquiry into legal categories, WTO dispute settlement organs have a variety of different options they can choose from. The range is extensive and—to a certain extent—what road is chosen may predetermine the outcome of the case before a panel or the AB. Consciously or not, panelists or AB members fall into one or a combination of these categories.

In a first step, it is useful to identify the schools of thought that do not find support in the language of the SPS Agreement. Neither purely probabilistic risk assessment nor the purely contextualist approach have found their way into WTO law. The very inclusion of Article 5.7 in the SPS Agreement—in which, according to the AB, the precautionary principle finds reflection—is a testament to the recognition that scientific inquiry is faced with inherent limitations. Similarly, the SPS Agreement's insistence on showing "sufficient scientific evidence" is a testament to an approach that cannot be based purely on a culturally determined understanding of risk.

The relevant approaches thus range from rational choice theory to a values-based jurisprudence. Both the SPS Agreement itself and the jurisprudence to date can provide insights into what approach may be the most appropriate given the distinct languages that both science and law possess. There appears to be a disparity between the panels and the AB stage in adjudicating the SPS disputes to date. At the risk of oversimplifying, it appears that the panels' track record has rarely reached beyond an approach that fits by and large the rational choice model. While panels paid lip-service to the jurisprudence of the AB, it is remarkable that, until the decision in *EC-Hormones*, panel reports have largely stayed uninfluenced by AB findings. The AB, on the other hand, has, beginning in its

very first finding on the SPS Agreement, hinted at giving WTO members considerable policy space.²¹¹ The reluctance of the panels—taken as a whole—is all the more remarkable given that the panel stage is designed as an organ without a great deal of permanency²¹² and is subject to appellate review.²¹³ Unlike the AB, panelists are temporary adjudicators, called upon to serve in individual disputes.²¹⁴ Thus, one can only speculate as to the reasons for the continued recalcitrance shown by the Panels on this issue.

This distinction becomes clearer when juxtaposing the findings of the panels and the AB in various instances. While a full review of the cases is beyond the scope of this Article and moreover unnecessary, the following analysis shows the dichotomy between the approaches that the panels and the AB have taken. This rift has, if anything, widened under the decision by the AB in the *US–Continued Suspension* case.

This distinction began early on in the disputes concerning the SPS Agreement—and at a fundamental level. The very first dispute brought to light the direction that the AB has followed ever since, by reversing the panel’s distinction between a stage of risk assessment and risk management.²¹⁵ Not only did the AB point out that there was no textual basis for the distinction between two such stages, but it arguably felt that this delineation between a science-based stage and one in which non-scientific, political decisions were to be made was too neat a dissection as to comport with reality.

Next, the AB, unlike the Panel in *EC–Hormones*, made clear that WTO members could not only rely on quantitative data in carrying out their risk assessment, but that the use of qualitative

211. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 124.

212. See J.H.H. Weiler, *The Rule of Lawyers and the Ethos of Diplomats: Reflections on the Internal and External Legitimacy of WTO Dispute Settlement*, 35 J. WORLD TRADE 191, 202 (2001). Out of the seven SPS disputes at the panel stage, five have been decided by panelists that have sat on more than one panel. Namely, panelists Bergholm, Cartland, Häberli, and Orozco have all sat on two panels. Out of six SPS disputes before the AB, only three have seen repeat players, which is not as surprising as the results at the panel stage given the design of the AB as a body composed of permanent members.

213. See Felix David, *The Role of Precedent in the WTO—New Horizons?* 10 (Maastricht Faculty of Law, Working Paper No. 2009-12, 2009).

214. Weiler, *supra* note 212, at 202.

215. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 181.

data is also permissible.²¹⁶ The AB thus again acknowledged that purely or even highly probabilistic risk assessments may not be able to capture the entirety of risk, but rather that there may be instances in which science has not yet advanced far enough to provide clear evaluations of how likely the realization of risk may be. Again, this potentially wide latitude of discretion was cabined through the requirement that there must be an “identifiable” or “ascertainable” risk, rather than merely theoretical uncertainty.²¹⁷

The AB found that the list of factors that may be taken into account in carrying out a risk assessment according to Article 5.2 of the SPS Agreement is not a closed one.²¹⁸ It did so from the very beginning and has continued to do so against panel findings which consistently imply that the list is at the very least limited to methods that lead to a probabilistic outcome.²¹⁹ It may be unfortunate that the AB has not made a clearer pronouncement on what it considers to be the boundaries for factors that may be taken into account in carrying out a risk assessment. Two lines of demarcation can be drawn however. A risk assessment is at its core a scientific undertaking, which implies that an overly-contextualized risk assessment is not acceptable. At the same time, given the AB’s general approach to science outlined above overreliance on rational choice type methodologies is equally outside of the acceptable realm for the AB.

These considerations are related to the question of setting the appropriate level of protection. As has been pointed out by the AB numerous times, it is the prerogative of the individual

216. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 253(j); Appellate Body Report, *Japan–Apples*, *supra* note 37, ¶ 179; *See* Panel Report, *EC–Hormones (Canada)*, *supra* note 37, ¶ 8.106.

217. Appellate Body Report, *Australia–Salmon*, *supra* note 37, ¶ 125; Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 186; *see also* Andrew T. Guzman, *Food Fears: Health and Safety at the WTO*, 45 VA. J. INT’L L. 1, 8 (2004).

218. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶¶ 187, 253(j).

219. For an overview of the jurisprudence of the early SPS cases, *see generally* Joost Pauwelyn, *The WTO Agreement on Sanitary and Phytosanitary (SPS) Measures as Applied in the First Three SPS Disputes EC–Hormones, Australia–Salmon and Japan–Varietals*, 2 J. INT’L ECON. L. 641 (1999); *see also* Kevin C. Kennedy, *Resolving International Sanitary and Phytosanitary Disputes in the WTO: Lessons and Future Directions*, 55 FOOD & DRUG L.J. 81, 91–99 (2000).

WTO member to set the appropriate level of protection.²²⁰ WTO members do not enjoy complete discretion in this regard, as a member's policy space is limited by the requirements of non-discrimination and proportionality in Articles 5.5 and 5.6.²²¹ Nevertheless, the AB recognized that the appropriate level of protection can be set at zero.²²²

Equally important, and divisive between some panels and the AB, has been the question of whether and if so, to what extent, it is acceptable for WTO members to rely on divergent scientific opinions in their risk assessment.²²³ In this context it is important to remember that the AB has reminded the panels numerous times that they cannot substitute their own considerations for the risk assessment of WTO members.²²⁴ The proper task for the panel is therefore not to attempt to find the "best science," but rather to inquire whether the scientific methods used in the process of assessing risk are accepted in the relevant scientific community.²²⁵ It almost appears as if the Panel in *EC–Continued Suspension* was fighting a rearguard action when it suggested a requirement of "critical mass" of evidence in the context of Article 5.7 of the SPS Agreement.²²⁶ When pressed for the origin of this standard, the Panel pointed out that the idea was prevalent in the sciences, especially in mathematics and physics.²²⁷ These findings were received with strong opposition by the AB, which made clear that it saw no basis for such a "critical mass" standard as it would almost by necessity require a paradigm shift in scientific discovery that, in the words of the AB, "is not frequent."²²⁸ This may be the prime example of how a panel either misunderstood the process of scientific inquiry or understood scientific evidence as consisting of almost entirely probabilistic inquiries. As pointed out above, such a narrow view of science is not commensurate with the realities of scientific discovery.

220. See, e.g., Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 124.

221. Appellate Body Report, *US–Continued Suspension*, *supra* note 37, ¶ 523 n.1088.

222. Appellate Body Report, *Australia–Salmon*, *supra* note 37, ¶ 125.

223. Appellate Body Report, *US–Continued Suspension*, *supra* note 37, ¶¶ 705–12.

224. See *id.* ¶ 590.

225. *Id.* ¶¶ 589–90.

226. *Id.* ¶ 6.141.

227. *Id.* ¶¶ 6.141, 6.141 n.294.

228. *Id.* ¶ 703.

Outside of the confines of the SPS Agreement, it has been argued²²⁹ that a further liberalization of the SPS disciplines could contravene the general rule contained in Article 19.2 of the DSU, which states that dispute settlement organs “cannot add to or diminish the rights and obligations provided in the covered agreements.”²³⁰ Whether this is indeed the case is open to debate. There is a difference between the rights and obligations that WTO members have and the expectations that WTO members derive from the agreements. It is certainly true that the panels and the AB do not enjoy unfettered discretion, but the degree to which this discretion can be exercised is debatable. This means that, taking the above spectrum as a yardstick, purely contextual approaches do not fit into the structure of the SPS Agreement. The same is probably true for the value-based jurisprudential approach as it also leaves too much discretion to member states. If the (not uncontroversial) goal of trade liberalization, with all its attendant costs and benefits, is to be taken seriously, then giving countries unfettered discretion to block trade is hard to reconcile with that goal. The AB recognizes not only the distinction between the languages of science and law as a technical challenge, but also recognizes that the role of adjudicatory bodies is to balance two competing objectives that are not only mentioned in the preamble of the SPS Agreement, but that are inherent in WTO law: the protection of human, animal or plant life or health on the one hand and trade liberalization on the other.

CONCLUSION

The interplay between science and law is more complicated than first meets the eye. And it is certainly more complex than the neat and clearly delineated world that law suggests. In the quest for legitimacy, the panels (as well as the AB in some instances, both within and outside the scope of the SPS Agreement) may have overlooked this complexity. There is a mismatch between law and science, a mismatch in which the former maintains a vision of the latter that is pure, seemingly

229. See, e.g., Lukasz Gruszczynski, *Science in the Process of Risk Regulation under the WTO Agreement on Sanitary and Phytosanitary Measures*, 7 GER. L.J. 371, 396 (2006).

230. DSU, *supra* note 9, art. 19.2.

able to affirmatively determine social conflicts on an objective basis. It is a view that is far removed from any contemporary understanding within the field of science itself. As Robin Feldman puts it: “the problem is not only that science cannot do for law what we think it can, the problem is also that science is not even what we think it is.”²³¹ Science is, however, “the best way to understand the way the world works” by “explaining physical, chemical, and biological processes” albeit with remaining “areas of ignorance.”²³²

Leaving aside the question of the divergence between the territorially bound power of any legal system and the claim to universality that is inherent in science, some argue that “[r]egulatory decision-making cannot do without, but must not exclusively rely on, expertise and science.”²³³ This has been identified as a particular problem in multi-level governance systems and the WTO has been criticized for allowing global standards to be imposed through its decision-making process.²³⁴ The AB recognized this when it found that risk assessment is not limited to the matters that are “susceptible of quantitative analysis by . . . empirical or experimental laboratory methods.”²³⁵

Following a probabilistic or rational choice approach has neglected taking into account the richer dimensions of science, which do not exist independently from the society in which they operate. While this may be a lamentable state for some, the AB’s more nuanced approach is responsive to the intricacies and complexities of scientific discovery and is at least cognizant of the varying viewpoints over certain risks. Its jurisprudence, especially in *EC–Continued Suspension*, points in a direction in which the results of scientific inquiry play a significant role, but not to the exclusion of all other factors. The AB recognizes that science is inherently characterized by uncertainty. This uncertainty being part of the language and indeed the very

231. FELDMAN, *supra* note 201, at 95.

232. Lewis Wolpert, *What Lawyers Need to Know about Science*, in 1 LAW AND SCIENCE: CURRENT LEGAL ISSUES 289, 289 (Helen Reece ed., 1998).

233. Joerges, *supra* note 73, at 15; see Howse, *supra* note 88, at 2341.

234. See JOERGES, *supra* note 73, at 18–19; Dario Bevilacqua, *The Codex Alimentarius Commission and its Influence on European and National Food Policy*, 2006 EUR. FOOD & FEED L. REV. 3, 13.

235. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 187.

culture of science must have an impact on the policy arena and ultimately the legal arena as well. As pointed out by others, “[f]ailure to do so, by insisting on a single estimate of risk (whether the ‘best’ estimate or otherwise), does not fully and truthfully describe the state of science at any moment.”²³⁶

Uncovering the different assumptions underlying the jurisprudence of the panels and the AB is therefore an important task. It was fortunate that the Panel in *EC–Continued Suspension* revealed its rationale when it required a “critical mass” standard for states to rely on when implementing a risk assessment. At the very least, the panel’s position allows for a discussion about the assumptions that the participants have when addressing highly consequential issues by making them public.²³⁷ The resolution of these differences has real consequences in a world in which we “live and work and die.”²³⁸

236. See Crawford-Brown et al., *supra* note 13, at 468.

237. See Hudec, *supra* note 1, at 86–87.

238. Appellate Body Report, *EC–Hormones*, *supra* note 37, ¶ 187.