A PARALLEL NARRATIVE: PLURALISTIC RECONCILIATION THROUGH QUANTIZING GEOECONOMICS IN (CYBER)SECURITY GOVERNANCE IN INTERNATIONAL ECONOMIC LAW

Xinyue Li[*]

ABSTRACT

This article reflects upon the theoretical implications of "quantizing geoeconomics", which is a framework established by quantum measurement analogy and holographic ontology to conceptualize geoeconomics in international economic law, through the quantizing postcritique course in (cyber)security governance. It establishes an ideal-typical taxonomy to examine the two uncomfortable facts of the dualistic classification of scholarship, and suggests a complementary parallel narrative through quantizing geoeconomics, emphasizing the geoeconomics of innovations and the probabilities of cybersecurity governance. It concludes with three approaches to a pluralistic reconciliation between (cyber)security protection and economic liberalization through quantizing geoeconomics, including establishing a pluralistic governance model, identifying national autonomy as the governance anchor, and achieving homeostasis for regulatory

[*] Xinyue Li is a PhD Candidate and Senior Tutor at Durham Law School, Deputy Director of the Centre for Chinese Law and Policy, GCP Scholar of Ustinov College, Associate Fellow at Higher Education Academy, Durham University, UK. The author can be reached at: xinyue.li@durham.ac.uk; m15000663015@163.com. The author is grateful to Professor Thom Brooks and Professor Ming Du, and the editors and anonymous reviewers for their insights on previous drafts. The author is also grateful for invaluable communications with colleagues at the Lauterpacht Centre for International Law during the visiting scholar journey at the University of Cambridge. All errors remain the author's own.

臺灣大學學術期刊資料庫

coordination. This work provides the first quantizing geoeconomics application through quantizing postcritique course; it highlights the theoretical implications of the open-realistic, quantum-based, and interdisciplinary scholarship, and calls for endeavors to experiment with quantum theories in international economic law.

KEYWORDS: *quantizing geoeconomics, quantum theories, cybersecurity governance, national security protection, economic liberalization, international economic law*

臺灣大學學術期刊資料庫

Table of Content

I. Introduction 91
II. Two Uncomfortable Facts of Classical Scholarship Under an Ideal-Typical Taxonomy 94
A. Optimistic Scholarship at Face Value: Reminiscently Pro-Multilateralism 98
B. Pessimistic Scholarship at Face Value: Representative Anti-Multilateralism 100
C. Optimism or Pessimism: Swing Votes on the Same Spectrum 103
III. Conceptualizing Cybersecurity Governance Through Quantizing Geoeconomics 106
A. Geoeconomics of Innovations 109
B. Possibilities in Cybersecurity Governance 110
IV. Pluralistic Reconciliation Between (Cyber)security Protection and Economic Liberalization Through Quantizing Geoeconomics 114
A. Establish Pluralistic Governance Model 114
B. Identify National Autonomy as Governance Anchor 116
C. Achieve Homeostasis Through Regulatory Coordination 118
V. Conclusion 120

I. INTRODUCTION

The international economic order is transforming from neoliberalism to geoeconomics, presenting the resurgence of security protection and deference to national autonomy in the context that security threats and economic issues are inseparable.[1] Emerging security threats are often interlinked with and complicated by their material foundations in the economy—hence cybersecurity has been brought to the center of the new generation disputes amid a data-driven economy, as one of the consequences of the eternal quests of innovation. Envisaged by Klaus Schwab's Fourth Industrial Revolution (hereinafter "4IR") framework, digital capabilities have powered a series of ongoing and future systematic transformations that innovate upon existing ways of sensing, calculating, communicating, organizing, and delivering.[2] Twelve extensions of data-driven innovations

[1] *See* Anthea Roberts et al., *Toward a Geoeconomic Order in International Trade and Investment*, 22(4) J. INT'L ECON. L. 655, 656 (2019).

[2] For an overview of the vision of Fourth Industrial Revolution (4IR), see generally KLAUS SCHWAB & NICHOLAS DAVIS, SHAPING THE FUTURE OF THE FOURTH INDUSTRIAL REVOLUTION: A GUIDE TO BUILDING A BETTER WORLD (2018); KLAUS SCHWAB, THE FOURTH INDUSTRIAL REVOLUTION (2017); Thomas Philbeck & Nicholas Davis, *The Fourth Industrial Revolution: Shaping a New Era*, 72(1) J. INT'L AFFS. 17 (2019). For a book review, see generally Betty Sue Flowers, *Technology and*

臺灣大學學術期刊論文

summarized by Schwab—blockchains, the Internet of Things, quantum computing, artificial intelligence and robotics, virtual and augmented reality, energy technologies, space technologies, advanced materials, additive manufacturing, biotechnologies, neurotechnology, and developing innovations that are as of yet unknown—coupled with global data flows[3] are accelerating the transformation to a data-driven economy. The looming problem, as many have noted, is that the progressive digitalization of the economy during the 4IR brings dynamic, interconnected, and multidimensional regulatory challenges that antiquated laws are, at best, ill-suited to address.[4] One such challenge is the untenable cybersecurity governance in international economic law, representing the most topical irreconciliation between security protection and economic liberalization in the emerging geoeconomic order.[5]

"Quantizing geoeconomics" is an interdisciplinary theoretical framework created to conceptualize the progressive but vulnerable research program of geoeconomics in international economic law by quantum theories, which builds upon three courses of quantum international relations (hereinafter "quantum IR"): analogy, actuality, and quantizing post-critique.[6] Following the historically constructed neutral definition of geoeconomics with the logic of selective accommodation, I rely on the analogy route by using quantum measurement theory as an analogy to suggest cooperative and competitive probabilities for the geoeconomic wave function, thus refusing the negative assertion of geoeconomics. Subsequently, I follow the ontology

Humanity in the Fourth Industrial Revolution, 72(1) J. INT'L AFFS. 179 (2018) (reviewing KLAUS SCHWAB & NICHOLAS DAVIS, SHAPING THE FOURTH INDUSTRIAL REVOLUTION (2018)).

[3] *See generally* SCHWAB, *supra* note 2; SCHWAB & DAVIS, *supra* note 2. For a definition of and evidence base for the role of data-driven innovations, see ORG. ECON. CORP. & DEV. [OECD], DATA-DRIVEN INNOVATION: BIG DATA FOR GROWTH AND WELL-BEING 19-54 (2015).

[4] *See* Henry Gao & Weihuan Zhou, *Governing Science and Technology Under the International Economic Order: Regulatory Divergence and Convergence in the Age of Megaregionals* by Shin-yi Peng, Han-Wei Liu and Ching-Fu Lin Edward Elgar Publishing, 2018, 20(3) WORLD TRADE REV. 369, 369-70 (2021) (book review); Manfred Elsig et al., *Introduction: Current Challenges and Future Scenarios*, *in* THE SHIFTING LANDSCAPE OF GLOBAL TRADE GOVERNANCE: WORLD TRADE FORUM 1, 2 (Manfred Elsig et al. eds., 2019); SCHWAB & DAVIS, *supra* note 2, at viii.

[5] For a systematic framework to understand cybersecurity risks, see Keman Huang et al., *A Systematic Framework to Understand Transnational Governance for Cybersecurity Risks from Digital Trade*, 12(5) GLOB. POL'Y 625, 628 (2021); Gregory Shaffer, *Trade Law in a Data-Driven Economy: The Need for Modesty and Resilience*, 20(3) WORLD TRADE REV. 259, 275-77 (2021); Berna Akcali Gur, *Restrictions on Trade in Telecommunications: WTO's Cybersecurity Conundrum*, 55(3) J. WORLD TRADE 477, 478-80 (2021); Tatiana Lacerda Prazeres, *Trade and National Security: Rising Risks for the WTO*, 19(1) WORLD TRADE REV. 137, 143 (2020); J. Benton Heath, *The New National Security Challenge to the Economic Order*, 129(4) YALE L.J. 1020, 1043 (2020) [hereinafter Heath, *The New National Security Challenge to the Economic Order*]; J. Benton Heath, *Trade and Security Among the Ruins*, 30(2) DUKE J. COMP. & INT'L L. 223, 234-39 (2020) [hereinafter Heath, *Trade and Security Among the Ruins*]; Shin-yi Peng, *Cybersecurity Threats and the WTO National Security Exceptions*, 18(2) J. INT'L ECON. L. 449, 449-50 (2015).

[6] *See* Xinyue Li, *Quantizing Geoeconomics: Emerging Geoeconomics in International Economic Law Under a Quantum Worldview*, 17(1) ASIAN J. WTO & INT'L HEALTH L. & POL'Y 5, 17 (2022).

臺灣大學學術期刊論文授權

path and argue that the geoeconomic order is a quantum system characterized by its holographic nature, which requires a quantum framework for the whole-part relation to properly understand the geoeconomic implications for international economic law. By using a quantum holographic ontology, I respond to the criticism on geoeconomics that the overt focus on the United States (hereinafter "US")-China rivalry is improper.

Despite the innovative establishment of the theoretical framework of quantizing geoeconomics in the previous work, which explicates how to conceptualize the geoeconomic paradigm shift through a quantum worldview, the framework has been criticized from two main perspectives. First, the justification for quantizing geoeconomics is unsound. It is believed that equivalent research outputs may be achieved by more "common" methods and that trailing through a "weird" theoretical route tends to overcomplicate the problem and is thus unnecessary for disciplinary development. Second, the impact of quantizing geoeconomics is explicitly confined. In order to make sense of a multidisciplinary theoretical framework, the readership of international economic law and international law are required to take significant leaps with this work to bridge several knowledge gaps among disciplines. As space is devoted to bridging these gaps, this research fails to provide pragmatic recommendations for the day-to-day professional practice of judges, lawyers, and decision-makers on real-world economic-security issues in a geoeconomic order, which seems to be the priority for excellent academic work. In response to these critiques, this article evaluates the theoretical implications of quantizing geoeconomics on the core issue of geoeconomics, which is the irreconciliation between security protection and economic liberalization, through the quantizing postcritique course, namely using quantum theories to critically analyze traditional scholarship. It takes cybersecurity in the data-driven economy as the laboratory in the geoeconomic order, employing the doctrinal methodology incorporated with conceptual legal research and critical international legal studies.

This article examines the theoretical potential of the framework of quantizing geoeconomics through the quantizing postcritique course, specifically its implications for the conceptualization of cybersecurity governance: this framework supplements the dualistic classification of optimistic and pessimistic scholarship on cybersecurity and provides a parallel approach to pluralistically reconcile (cyber)security and economic liberalization within the geoeconomic order. Part II introduces the emerging battlefield of cybersecurity governance that is induced by the rapidly evolving data-driven innovations in the digital economic transformation during the 4IR. By establishing an ideal-typical taxonomy, this paper examines how the classification of scholarly traditions of optimism and pessimism have contributed, or failed to contribute, to the conceptualization

臺灣大學學術期刊資料庫

of the conflict between cybersecurity and economic liberalization, disclosing two uncomfortable facts that render such a dualistic approach insufficient for informing (cyber)security governance in a geoeconomic order. In response to the swing votes of traditional scholars, Part III presents a complementary parallel narrative by advancing pragmatism through quantizing geoeconomics, demonstrating the geoeconomics of innovations and cybersecurity governance probabilities based on a quantum measurement analogy. Part IV experiments with quantum holographic ontology in quantizing geoeconomics on cybersecurity governance, suggesting three approaches for the pluralistic reconciliation between (cyber)security concerns and economic liberalization in a geoeconomic order. This work is the first attempt to articulate the theoretical implications of quantizing geoeconomics through the quantizing postcritique course since the framework's establishment and macroscopic application. At the core of this work is an effort to incorporate a quantum worldview into international economic law, inspiring scholars to adapt international economic law to the complex geoeconomic order and expand its outreach across disciplines and to younger generations. In this spirit, the parallel narrative I propose is designed to operate as an "as if" exploration, furthering continuous debates and experimentations with quantum theories in international law.

II. TWO UNCOMFORTABLE FACTS OF CLASSICAL SCHOLARSHIP UNDER AN IDEAL-TYPICAL TAXONOMY

Cybersecurity refers to a vast array of measures taken to safeguard digital systems against unauthorized access and attacks, ranging from vulnerability reduction and incident response to proactive deterrence policies that defend the global information and communication infrastructure from cyber threats.[7] Cybersecurity failures have catastrophic consequences, including brand damage due to corporate espionage; financial risks derived from data breaches; strategic risks to critical infrastructure in the electricity, oil and gas, and water sectors; military turmoil caused by network disruptions; and worst of all, loss of life and resources.[8] The World Economic Forum 2020 reported that cyberattacks, data fraud or theft,

[7] *See* Neha Mishra, *The Trade: (Cyber)Security Dilemma and Its Impact on Global Cybersecurity Governance*, 54(4) J. WORLD TRADE 567, 567 (2020); Gabriele Gagliani, *Cybersecurity, Technological Neutrality, and International Trade Law*, 23(3) J. INT'L ECON. L. 723, 725 (2020).

[8] *See* THE NEW YORK STOCK EXCHANGE [hereinafter NYSE] GOVERNANCE SERVICES, A 2015 SURVEY: CYBERSECURITY IN THE BOARDROOM 4 (2015), https://www.nyse.com/publicdocs/VERACODE_Survey_Report.pdf; NYSE GOVERNANCE SERVICES, NAVIGATING THE DIGITAL AGE: THE DEFINITIVE CYBERSECURITY GUIDE FOR DIRECTORS AND OFFICERS, iii, 12, 33 (2015); ROBERT K. KNAKE, INTERNET GOVERNANCE IN AN AGE OF CYBER INSECCURITY 5-6 (2010); STEWART BAKER ET AL., IN THE CROSSFIRE: CRITICAL INFRASTRUCTURE IN THE AGE OF CYBER WAR 1 (2010), https://www.govexec.com/pdfs/012810j1.pdf.

臺灣大學學術期刊資料庫

information infrastructure breakdown, and adverse technological advancements are incidents with the highest likelihood of causing global technological risk and the capability to generate negative chain effects in economic, environmental, geopolitical, and societal areas.[9] Cybersecurity in today's data-driven economy thus extends beyond cyberspace and generates recurring and pressing concerns that are hyperconnected to humans both philosophically and physically.[10] On the one hand, cybersecurity complicates the ever-lasting search of ontology in terms of concepts, dimensions, metrics, and systems[11] and fuels the constructivism debate by Susskind on the extent to which humans should be directed and controlled by digital systems.[12] On the other hand, it induces security risks along two dimensions: national cybersecurity risks and global supply chain cybersecurity risks.[13] Whereas the latter concerns the cybersecurity risks of buyers and suppliers, the former is classified into four categories—military, economic, political, and societal cybersecurity risks. This article focuses on the cybersecurity risks that lie below the use of force threshold[14] and are predominantly addressed by governmental economic strategies, including digital economic norms, policies, and laws.[15] The relevance of such an issue for international economic law stems precisely from the fact that the legal definition of what constitutes national cybersecurity is intentionally vague so as to provide political operating space,[16] resulting in intensively discussed regulatory differences in scholarship based on distinct approaches to cybersecurity conceptualization and governance.[17]

Literature on cybersecurity governance in international economic law, unlike quantum theories in international law, presents a picture of prosperity and is even close to forming a buyer's market as a response to the features of the digital economy, including inherent interconnectivity, cross-border coverage, and the exponential rise in data-driven innovations.[18] The reasons for the application of the theoretical framework of quantizing geoeconomics herein are two uncomfortable facts about the dualistic classification of

[9] *See generally* WORLD ECON. F., THE GLOBAL RISKS REPORT 2020: AN UNSETTLED WORLD (2021), http://www3.weforum.org/docs/WEF_Global_Risk_Report_2020.pdf.
[10] For a shared concept of cyberspace, see NAZLI CHOUCRI & DAVID D. CLARK, INTERNATIONAL RELATIONS IN THE CYBER AGE: THE CO-EVOLUTION DILEMMA 33 (2018).
[11] *See id.* at 212.
[12] *See generally* JAMIE SUSSKIND, FUTURE POLITICS: LIVING TOGETHER IN A WORLD TRANSFORMED BY TECH (2018).
[13] *See* Huang et al., *supra* note 5, at 626-29.
[14] For military cybersecurity risks, see generally TALLINN MANUAL 2.0 ON THE INTERNATIONAL LAW APPLICABLE TO CYBER OPERATIONS (Michael N. Schmitt & Liis Vihul eds., 2d ed. 2017).
[15] *See* Huang et al., *supra* note 5, at 629-32.
[16] *See* Gagliani, *supra* note 7, at 726.
[17] *See* Mishra, *supra* note 7, at 568.
[18] For features of the digital economy, see generally Thomas Streinz, *Digital Megaregulation Uncontested? TPP's Model for the Global Digital Economy*, *in* MEGAREGULATION CONTESTED: GLOBAL ECONOMIC ORDERING AFTER TPP 312 (Benedict Kingsbury et al. eds., 2019).

臺灣大學學術期刊論文

existing scholarship. I disclose these facts by developing an ideal-typical taxonomy, distinguishing three issues that are essential to cybersecurity governance: (1) whether innovations are value neutral; (2) whether and when cybersecurity protection should outweigh economic liberalization or vice versa; and (3) how to reconcile data-driven economic convergence and cybersecurity concerns, or more specifically, how to protect cybersecurity in the digital economy by governance models at international, regional, and national levels. This taxonomy helps to identify what appears to be deeply divided but in fact entwined scholarships of optimism and pessimism, along with their incompatibilities in the geoeconomic order. It also shows that, as presented in Table 1, based upon different rationales regarding issue (1), there are two firm positions in classical scholarship regarding issue (2), leading to what appears to be binary either–or preferences for governance models in (3), which are, in fact, swing votes on the same spectrum that are insufficient in the geoeconomic order theoretically and practically.

臺灣大學學術期刊資料庫

TABLE 1: An Ideal-Typical Taxonomy for Classical Scholarship of Cybersecurity Governance

	Rationales	*Presentations*	***Solutions at Face Value***
	(1) Whether innovations are value-neutral	(2) Whether and when cybersecurity protection should outweigh economic liberalization or vice versa	(3) How can data-driven economic convergence and cybersecurity concerns be reconciled
Scholarship of Optimism	No, innovations are created to benefit humankind as a whole.	Predominated by neoliberal, deeming that cybersecurity protection scarcely outweighs economic liberalization in the whole process of economic development.	Reminiscently pro-multilateralist: Advocates for rule-based multilateral governance models, such as the WTO system.
Scholarship of Pessimism	No, innovations are disruptive and uncontrollable; they are determined by tools for political ideology and are developed to pursue certain agendas.	Predominated by nationalists, deeming that cybersecurity and national security protection are priorities, especially in a data-driven economy.	Representatively anti-multilateralist: Advocates for regional and bilateral governance models, such as CPTPP and PTAs, but views them as laboratories for advancing governance cooperation in a multilateral forum.

臺灣大學學術期刊資料庫

A. Optimistic Scholarship at Face Value: Reminiscently Pro-Multilateralism

Many, if not most, commentators on the data-driven economy and innovation are scientific and technological optimists, as technological improvements and capital accumulation are two determinants of economic progress in Keynes economic theory.[19] That is, in a first-best economy in which individuals are fully insured against any adverse effects of the creation and redistribution of innovations, scientific and technological possibilities can be unambiguously positive and transform into utility possibilities.[20] As such, optimistic scholarship holds that innovations are created for the common good of humanity—specifically, data-driven innovations liberalize the economy and thus enhance aggregate economic benefits and social welfare that countries should enjoy, and in turn, a liberalized economy spurs data-driven innovation.

If one is an innovation optimist, then the task is rather productive: international economic law should incentivize data-driven scientific and technological creation, commercialization, and adoption for the benefit of humanity. As such, liberalizing the data-driven economy becomes a priority in rulemaking, while cybersecurity protection is marginalized as one subcategory in the reinterpretation or expansion of traditional security exceptions, which reveals the rooted philosophy of neoliberalism. While recognizing potential multidimensional cybersecurity risks that accompany the velocity of the data-driven economy during the 4IR, optimistic scholars emphasize the proper usage and positive effect of data-driven innovations to facilitate economic growth. The challenge for these scholars, then, is to combat data nationalism or, as described by Liu, "techno-nationalism", understood as excessive government intervention that targets scientific and technological industries of strategic importance to secure national economic competitiveness and security interests.[21] Intervention measures that are widely criticized include restrictions on cross-border data flows such as data localization requirements,[22] the establishment of technical standards such as

---

[19] *See* 9 JOHN MAYNARD KEYNES, *Economic Possibilities for Our Grandchildren (1930)*, *in* THE COLLECTED WRITINGS OF JOHN MAYNARD KEYNES: IX ESSAYS IN PERSUASION 321, 323 (Elizabeth Johnson & Donald Moggridge eds., 2013).

[20] *See* Anton Korinek & Joseph E. Stiglitz, *Artificial Intelligence and Its Implications for Income Distribution and Unemployment*, *in* THE ECONOMICS OF ARTIFICIAL INTELLIGENCE: AN AGENDA 349, 353 (Ajay Agrawal et al. eds., 2019).

[21] *See* Han-Wei Liu, *China Standard Time: The Boundary of Techno-Nationalism in Megaregionals*, *in* GOVERNING SCIENCE AND TECHNOLOGY UNDER THE INTERNATIONAL ECONOMIC ORDER: REGULATORY DIVERGENCE AND CONVERGENCE IN THE AGE OF MEGAREGIONALS 114, 118 (Shin-yi Peng et al. eds., 2018); Anupam Chander & Uyên P. Lê, *Data Nationalism*, 64(3) EMORY L.J. 677, 680-81 (2015).

[22] *See generally* Martina F. Ferracane, *The Costs of Data Protectionism*, *in* BIG DATA AND GLOBAL TRADE LAW 63 (Mira Burri ed., 2021); *see also* Neha Mishra, *Privacy, Cybersecurity, and GATS*

臺灣大學學術期刊資料庫

new digital taxes,[23] the expansion of regulatory standards such as investment screening mechanisms for sensitive data protection,[24] and even negotiations over new rules at regional and bilateral levels specifically relating to data transfers, [25] constituting what optimistic scholars deem a rise in protectionism that is impeding progress in the data-driven economy.[26]

Solutions proposed by optimistic scholars are, if not understated, reminiscently pro-multilateralism. The term multilateralism herein specifically refers to norms governing emerging matters of cybersecurity in a data-driven economy. In other words, these scholars continue to promote multilateral governance by reinforcing the World Trade Organization (hereinafter "WTO") governance framework, by reinterpreting legal concepts, expanding application scopes, or reforming the WTO's institutional and substantial regulations to suit the data-driven economy, underestimating challenges resulting from both the breadth and depth of the data-driven 4IR and the ongoing paradigm shift to a geoeconomic order. Upholding multilateral obligations such as national treatment and nondiscrimination, Kwak and Hu further advance principles of the same nature, i.e., the principle of technological neutrality, meaning that economic regulations are equally applicable to trade and investment regardless of the transaction means caused by technological changes.[27] Inasmuch as the principle of technological neutrality can bridge the gap between the traditional world economic regime and the digital nature of the economy, as optimistic scholars believe, both the WTO and its member states are accused of taking the stand of strategical neutrality and expressing reluctance to confirm it as a general principle within the multilateral system.[28] Another

Article XIV: A New Frontier for Trade and Internet Regulation?, 19(3) WORLD TRADE REV. 341, 342 (2019).

[23] *See* Gary Clyde Hufbauer & Zhiyao (Lucy) Lu, *The European Union's Proposed Digital Services Tax: A De Facto Tariff*, PETERSON INST. FOR INT'L ECON. (June, 2018), https://www.piie.com/publications/policy-briefs/european-unions-proposed-digital-services-tax-de-facto-tariff.

[24] *See* Heath, *Trade and Security Among the Ruins*, *supra* note 5, at 236-37.

[25] *See generally* Mira Burri, *Data Flows and Global Trade Law*, *in* BIG DATA AND GLOBAL TRADE LAW 11 (Mira Burri ed., 2021); Streinz, *supra* note 18, at 314.

[26] *See generally* Susan Ariel Aaronson, *What Are We Talking About When We Talk About Digital Protectionism?*, 18(4) WORLD TRADE REV. 541 (2018).

[27] Appearing first in the official World Trade Organization [hereinafter WTO] document as the United States submission for the Work Programme on Electronic Commerce in 1999, the principle of technological neutrality was proposed to uphold the guideline that market access and national treatment commitments should encompass the cross-border delivery of the service through electronic means. *See* WTO, *Work Programme on Electronic Commerce – Submission by the United States*, at 3, WTO Doc. WT/GC/16, G/C/2, S/C/7, IP/C/16, WT/COMTD/17 (Feb. 12, 1999); Dongchul Kwak, *No More Strategical Neutrality on Technological Neutrality: Technological Neutrality as a Bridge Between the Analogue Trading Regime and Digital Trade*, 21(1) WORLD TRADE REV. 18, 19 (2022); Jia-Xiang Hu, *When Trade Encounters Technology: The Role of the Technological Neutrality Principle in the Development of WTO Rules*, *in* SCIENCE AND TECHNOLOGY IN INTERNATIONAL ECONOMIC LAW: BALANCING COMPETING INTERESTS 75 (Bryan Mercurio & Kuei-Jung Ni eds., 2013).

[28] There is a lack of consensus at the institutional level on the principle of technological neutrality,

臺灣大學學術期刊資料庫

example of reminiscently pro-multilateralism is a rather ambitious proposal by Mitchell and Mishra, in which they emphasize the reform of the WTO framework to accommodate policy challenges in the data-driven economy because the WTO is the leading multilateral system with the largest global membership and has rigorously debated electronic commerce.[29] Despite taking into account new situations, including inclusive regulatory approaches that consider the multistakeholder nature of digital governance and preferential trade agreements (PTAs) such as Comprehensive and Progressive Agreement for Trans-Pacific Partnership (hereinafter "CPTPP"), optimistic scholars recommend a novel WTO framework to regulate atypical areas that are commonplace in digital trade, requiring member states to adopt binding provisions on data localization and cybersecurity with the aim of facilitating internet openness.[30] More suggestions of the same nature, urging reforms for WTO 2.0, a reinforced and rule-based multilateral system that governs cyberspace for the digital economy, can be easily identified in the literature.[31]

B. Pessimistic Scholarship at Face Value: Representative Anti-Multilateralism

Contrary to optimistic scholarship, pessimistic scholarship generally views data-driven scientific and technological advances as pitfalls in disguise. Instead of being dazzled by the possibilities brought by the beyond-human capabilities of 4IR innovations, they deem the relentless parade of data-driven innovations as particularly disruptive and uncontrollable, giving rise to moral hazards, labor unrest, industrial upheaval, and societal chaos, which increase the costs for political decision-making and regulatory upgrades.[32] A subtle link to Schumpeter's prophet of innovation, which he

since no further elaboration was provided in WTO official documents to clarify its definition and scope, and no provision deliciated to the principle is established in any WTO agreement as of today. *See generally* Kwak, *supra* note 27.

[29] *See* Andrew D. Mitchell & Neha Mishra, *Regulating Cross-Border Data Flows in a Data-Driven World: How WTO Law Can Contribute*, 22(3) J. INT'L ECON. L. 389, 390-91 (2019).

[30] Andrew D. Mitchell & Neha Mishra, *WTO Law and Cross-Border Data Flows: An Unfinished Agenda*, *in* BIG DATA AND GLOBAL TRADE LAW 83, 112 (Mira Burri ed., 2021); Mitchell & Mishra, *supra* note 29, at 416.

[31] *See* Olia Kanevskaia, *ICT Standards Bodies and International Trade: What Role for the WTO?*, 56(3) J. WORLD TRADE 429, 431 (2022); Petros C. Mavroidis, *Regulatory Cooperation in the WTO: Why It Matters Now? How Could It Be Achieved?*, *in* GOVERNING SCIENCE AND TECHNOLOGY IN THE ERA OF MEGAREGIONALS 12, 36 (Shin-Yi Peng et al. eds., 2018); Shin-yi Peng, *"Private" Cybersecurity Standards? Cyberspace Governance, Multistakeholderism, and the (Ir)Relevance of the TBT Regime*, 51 CORNELL INT'L L.J. 445, 468-69 (2018).

[32] *See generally* Mira Burri, *Understanding and Shaping Trade Rules for the Digital Era*, *in* THE SHIFTING LANDSCAPE OF GLOBAL TRADE GOVERNANCE: WORLD TRADE FORUM 73 (Manfred Elsig et al. eds., 2019); Eli Noam, *Inequality and the Digital Economy*, *in* DIGITIZED LABOR: THE IMPACT OF THE INTERNET ON EMPLOYMENT 117 (Lorenzo Pupillo et al. eds., 2018); James Manyika et al., *Disruptive Technologies: Advances that Will Transform Life, Business, and the Global Economy* ,

臺灣大學學術期刊論文版權

uses to describe how innovative capitalist products and methods are a process that propels the capitalist economy with "the perennial gale of creative destruction", can be observed.[33] Innovation, as Schumpeter says, is an "industrial mutation" that "incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one."[34] Yet the pessimistic scholarship departs from the value-neutral, scientifically precise, and experience-loyal Schumpeterian vision [35] that highlights the "creative destruction" evidenced by the "evolutionary character" of the long-term performance of the ever-changing economy;[36] and instead, it primarily viewing data-driven innovations as strategic tools with an obscure political agenda, a disappointed value- or ideology-oriented perspective, and a rejection of the consensus on economic openness. Political push is often predominant in discussions by pessimistic scholars: cybersecurity threats are evaluated on grounds of "genuine or strategic political theatre";[37] and how states react and position themselves in changing international relations reveals their willingness to cooperate, which determines the reining economic order and governance model.[38]

If one is an innovation pessimist, then the task is fairly clear: international economic law should give way to cybersecurity and national security protection, with the latter intervening to a great extent in data-driven scientific and technological creation, commercialization, and adoption for domestic security and stability. The challenges for the optimistic scholarship, the aforementioned techno-nationalistic measures, are conversely rationalized by pessimistic scholarship. Data localization requirements, as an example, are understood as complex international policy issues that have the

---

MCKINSEY & CO. (May, 2013), https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/disruptive%20technologies/mgi_disruptive_technologies_full_report_may2013.pdf.

[33] *See* JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM AND DEMOCRACY 73, 76 (Harper & Brothers 1942) (2010); Thomas C. Leonard, *Redeemed by History*, 17(1) HIST. ECON. IDEAS 189, 191-92 (2009).

[34] *See* SCHUMPETER, *supra* note 33, at 73.

[35] Schumpeter believed that Karl Marx and his own contemporary, John Maynard Keynes, who were mentioned earlier when discussing the scholarship of optimism, had been profoundly correct on many issues but wrong on others due to the trap of an unyielding ideology—or, as Schumpeter put it, "vision". However, while Schumpeter aspired to be, as Thomas says, "a value-neutral social scientist whose work remined pristine and untainted by ideology," he was also somewhat hindered by his own distinctive "vision": the deepest analytical tension between determinism and contingency. After all, his life was dedicated to an "overarching [attempt] to capture a whole socioeconomic system in a few grand generalizations," as commended by the Nobel-Prize winning economist Robert M. Solow. *See* THOMAS K. MCCRAW, PROPHET OF INNOVATION: JOSEPH SCHUMPETER AND CREATIVE DESTRUCTION 5 (2010); Robert M. Solow, *Heavy Thinker*, THE NEW REP. (May 21, 2007), https://newrepublic.com/article/61183/heavy-thinker.

[36] SCHUMPETER, *supra* note 33, at 72.

[37] John Selby, *Data Localization Laws: Trade Barriers or Legitimate Responses to Cybersecurity Risks, or Both?*, 25(3) INT'L J. L. & INFO. TECH. 213, 228 (2017).

[38] *See* Burri, *supra* note 25, at 41; Burri, *supra* note 32, at 101.

臺灣大學學術期刊資料庫

capacity to support domestic security and law enforcement and arguably, the capacity to support domestic stability. The former can be realized in terms of protecting information against foreign intelligence agencies by at least increasing the cost of mass surveillance, as critically analyzed by Selby when refuting what Chander and Lê otherwise suggest.[39] It can also be seen in evidence regarding advantages in the reaction of local law enforcement to cybercrimes committed by individuals whom cooperative governance models fail to support and in the efforts of local law enforcement to minimize political interventions and secure evidence in a timely manner.[40] The contribution to the latter, domestic stability, is argued from a political perspective in that measures of a protectionist nature contribute to maintaining domestic stability against foreign intervention and external existential threats, as proven by historical events across capitalist and socialist countries.[41]

Pessimistic scholarship, as quite the opposite of the reminiscent pro-multilateralism among the optimistic scholarship, hence chooses solutions that are representatively anti-multilateralism. For example, in terms of policymaking, instead of promoting harmonization, pessimistic scholarship suggests that national data strategy should be developed first before moving toward interoperable approaches, especially considering developing countries that are not yet ready for building a regulatory environment for data-driven economy.[42] In regard to transnational rulemaking, given that the WTO's multilateral system is regarded as being paralyzed since its judicial transplants cannot replace member states' political consensus and legal adaptation within the multilateral system has failed,[43] two solutions are proposed against this contentious political backdrop. The first is to narrow down the scope for negotiations regarding the data-driven economy by excluding politically sensitive issues such as cybersecurity and national security, and the second is to pursue a flexible, cooperative solution involving only a small number of countries.[44] Venues such as FTAs and mutual recognition agreements work better than other methods for reconciling diverging interests on long-standing and politically sensitive domains in the data-driven economy and thus benefit partners by offering

[39] *See* Selby, *supra* note 37, at 228; Chander & Lê, *supra* note 21, at 714-18.
[40] *See* Smitha K. Prasad, *State Sovereignty in the Cyberspace and the Free Flow of Data*, *in* REGULATING THE CYBERSPACE: PERSPECTIVES FROM ASIA 65, 65-67 (Gisela Elsner & Aishwarya Natarajan eds., 2020); Selby, *supra* note 37, at 230.
[41] *See* Selby, *supra* note 37, at 231; Jan Stanley & Barry Steinhardt, *Bigger Monster, Weaker Chains: The Growth of an American Surveillance Society*, *in* ETHICS AND EMERGING TECHNOLOGIES 269, 269 (Ronald L. Sandler ed., 2014).
[42] *See* Susan Ariel Aaronson, *Data Is Different, So Policymakers Should Pay Close Attention to Its Governance*, *in* BIG DATA AND GLOBAL TRADE LAW 340, 354, 359 (Mira Burri ed., 2021).
[43] *See* Burri, *supra* note 32, at 93-94; Chimene I. Keitner & Harry L. Clark, *Cybersecurity and Trade Agreements: The State of the Art*, 10 HARV. BUS. L. REV. ONLINE 1, 8 (2019-2020).
[44] *See* Mira Burri, *Towards a New Treaty on Digital Trade*, 55(1) J. WORLD TRADE 77, 99-100 (2021).

臺灣大學學術期刊論文集

quicker solutions and clearer provisions on essential security protection.[45] Moreover, having larger groups of countries under the CPTPP and Regional Comprehensive Economic Partnership (hereinafter "RCEP") or other megaregulations[46] to determine fundamental norms on data localization, data flow, and open internet access provides a concrete basis for model replication and governance cooperation, offering potential channels for reaching political consensus on areas of essential interest.[47] At face value, therefore, pessimistic scholarship offers practical solutions for cybersecurity governance that are representatively anti-multilateralism.

C. Optimism or Pessimism: Swing Votes on the Same Spectrum

However, the portrayal of classical scholarship as optimism and pessimism by their first-instance arguments is arguably simplistic, as the dualistic approach obscures the nuances of the debate. A basic binary assumption underlies much of the dualistic classification—namely, the notion that there is an inherent trade-off between global trade interdependence, on the one hand, and domestic economic security, on the other, and that the pursuit of economic liberalization under neoliberalism is incompatible with the pursuit of economic resilience, or in other words, security protection, under nationalism.[48] It portraits a reality obscured by presenting different objectives as an either-or choice, while largely overlooking the fact that seemingly paradoxical objectives are often interconnected and mutually reinforcing.[49]

The attempts to break the binary either-or assumption in offering preferred governance models can be seen in the pessimistic scholarship. Underneath the apparently strong feelings against the multilateralist vision, one can find the innovation pessimists' attachment to multilateralism, which is why one may see swing votes from the same scholar at different times across the pro- or anti-multilateralism spectrum. These scholars themselves

---

[45] *See* Burri, *supra* note 25, at 40; Burri, *supra* note 32, at 100. For the definition and discussion on mutual recognition agreements as regulatory cooperation regime, see Usman Ahmed, *The Importance of Cross-Border Regulatory Cooperation in an Era of Digital Trade*, 18 WORLD TRADE REV. (SPECIAL ISSUE) S99, S115-17 (2019).

[46] For an overview on megaregulation, see Benedict Kingsbury et al., *Introduction: The Essence, Significance, and Problems of the Trans-Pacific Partnership*, *in* MEGAREGULATION CONTESTED: GLOBAL ECONOMIC ORDERING AFTER TPP 1, 3-4 (Benedict Kingsbury et al. eds., 2019); Benedict Kingsbury et al., *The Trans-Pacific Partnership as Megaregulation*, *in* MEGAREGULATION CONTESTED: GLOBAL ECONOMIC ORDERING AFTER TPP 27, 27-28 (Benedict Kingsbury et al. eds., 2019).

[47] *See* Burri, *supra* note 44, at 96-100; Keitner & Clark, *supra* note 43, at 2.

[48] The WTO re-evaluates this assumption in response to the COVID-19 pandemic and the rising frequency and severity of natural and man-made disasters. *See generally* WTO, WORLD TRADE REPORT 2021: ECONOMIC RESILIENCE AND TRADE (2021), https://www.wto.org/english/res_e/booksp_e/wtr21_e/00_wtr21_e.pdf.

[49] *See id*. at 7.

臺灣大學學術期刊資料庫

admit that politically oriented protection measures unavoidably generate adverse effects in the long term and that neither the narrow scope nor the group solution is the best, sufficiently ambitious option.[50] Data localization is mostly conceived of as a protectionist measure that leads to small gains in the short term and causes tremendous harm that spreads across the global economy.[51] Free trade agreements (hereinafter "FTAs") or mutual recognition agreements are indeed patchworks in that they are overlapping agreements that exacerbate asymmetric wealth distribution and rule fragmentation.[52] As "a piecemeal approach" that creates a "spaghetti bowl" of vulnerable standards, FTAs also undermine the value and impact of multilateralism.[53] Even wildly praised megaregional governance models such as the CPTPP and RCEP are understood as building upon questionable consensuses to liberalize the data-driven economy, since commitments are usually riddled with broadly formulated exceptions and are subject to curve-outs with respect to national autonomy, particularly on cybersecurity and national security issues.[54] In other words, on the one hand, pessimistic scholarship reverts to short-term fixes with maximum flexibility in so-called politicized domains and minimum commitment to economic liberalization; on the other hand, it treats regional or bilateral models as governance laboratories to find paths for engaging in regulatory cooperation in multilateral forums.[55] Moving forward, pessimistic scholarship needs to find ways to consolidate consensus and enhance regulatory cooperation to balance cybersecurity, national security protection and data-driven economic liberalization amid the challenges of 4IR in the geoeconomic order,[56] inevitably following and transforming to what I call the noblest vision of optimistic scholarship.

The noblest vision of the optimist camp, or perhaps for almost all international economic and legal scholars regardless of their side, is idealistic multilateralism. Nonetheless, as empirical evidence indicates, it is extremely difficult, if not impossible, to reach a consensus on the main regulatory issues of the data-driven economy during the 4IR within the decades-old WTO system—especially in a geoeconomic order in which great powers hold distinct positions, sparking antagonism throughout the establishment of proper governance models.[57] As Mitchell and Mishra remark at the end of

[50] *See* Burri, *supra* note 44, at 100.
[51] *See* Joshua P. Meltzer, *Governing Digital Trade*, 18 WORLD TRADE REV. (SPECIAL ISSUE) S23, S48 (2019); Chander & Lê, *supra* note 21, at 722.
[52] *See* Burri, *supra* note 32, at 100.
[53] Ahmed, *supra* note 45, at S116.
[54] *See generally* Simon B.C. Lacey, *Reality Check: The Lack of Consensus on New Trade Rules to Govern the Digital Economy*, 54(2) J. WORLD TRADE 199 (2020).
[55] *See* Burri, *supra* note 25, at 41.
[56] *See id.* at 41; Ahmed, *supra* note 45, at S120.
[57] *See* Aaronson, *supra* note 42, at 342; Elli Louka, *The New Trade Order: Conflicts, Internet Standards and Human Security*, 55(6) J. WORLD TRADE 921, 921 (2021); Simon Abendin &

臺灣大學學術期刊資料庫

their ambitious proposal, such a comprehensive WTO framework for the digital economy requires "increased participation, goodwill, and commitment of countries,"[58] all of which have been in short supply during the 2020s. Even such a seemingly modest remark exudes sheer optimism—as the universal nature of the organization requires any WTO reform to represent well-balanced rights and obligations that are acceptable to all members.[59] Nevertheless, optimistic scholars still make tremendous efforts to advocate for the multilateral system, or even further, a balanced, multidimensional cooperative governance framework, as they wish to address various facets of regulatory challenges brought by data-driven innovations in a geoeconomic world.[60]

Thus far, I have emphasized two uncomfortable facts about the dualistic classification of optimistic and pessimistic scholarship regarding cybersecurity governance. One is the inability of optimists to implement enforceable binding norms to prevent techno-nationalism by restructuring and revitalizing the WTO multilateral system. The other is the inability of pessimists to self-sustain without moving toward the multilateral governance model or any models with a greater degree of regulatory cooperation. I refer to these facts as "uncomfortable" because they cast doubt on what is considered to be the underlying arguments of classical scholarship of cybersecurity governance. As such, they will continue to exist and generate concerns and insecurities, even if one dismisses the use of quantizing geoeconomics. These facts, in other words, are among the reasons for establishing an interdisciplinary theoretical framework of quantizing geoeconomics, through applying quantum measurement and holism theories at the analogical and ontological levels, respectively, and applying it via the quantizing postcritique course, to both conceptualize geoeconomics and reflect upon the existing scholarship on cybersecurity governance.

Pingfang Duan, *Global E-Commerce Talks at the WTO: Positions on Selected Issues of the United States*, *European Union, China, and Japan*, 20(5) WORLD TRADE REV. 707, 720 (2021); Lacey, *supra* note 54, at 213-14; R. S. Neeraj, *Trade Rules for the Digital Economy: Charting New Waters at the WTO*, 18 WORLD TRADE REV. (SPECIAL ISSUE) S121, S122-23 (2019); Quynh Nguyen & Gabriele Spilker, *The Elephant in the Negotiation Room: PTAs Through the Eyes of Citizens*, *in* THE SHIFTING LANDSCAPE OF GLOBAL TRADE GOVERNANCE: WORLD TRADE FORUM 17, 20 (Manfred Elsig et al. eds., 2019).

[58] Mitchell & Mishra, *supra* note 30, at 112; Mitchell & Mishra, *supra* note 29, at 416.

[59] *See* Michael Hahn, *For Whom the Bell Tolls: The WTO's Third Decade*, *in* THE SHIFTING LANDSCAPE OF GLOBAL TRADE GOVERNANCE: WORLD TRADE FORUM 121, 125 (Manfred Elsig et al. eds., 2019).

[60] *See* Mishra, *supra* note 22, at 364.

臺灣大學學術期刊資料庫

III. CONCEPTUALIZING CYBERSECURITY GOVERNANCE THROUGH QUANTIZING GEOECONOMICS

The optimistic and pessimistic scholarship, which are at face value on opposite ends of the same spectrum and obscured by the binary either-or assumption, place the classical understanding of cybersecurity governance in relation to international economic law in a precarious position. If neither narrative alone is sufficient for cybersecurity governance in the geoeconomic order, then is a choice between the two truly necessary? Consequently, if the binary either-or assumption is undesirable in the geoeconomic order, what types of scholarship, ontology, and perception may support scholarly endeavors to reconcile security protection with economic liberalization?

On the principle that desperate times call for desperate measures, there is new relevance to the hypothesis of quantizing geoeconomics, which proposes that cybersecurity threats and their governance in international economic law within the geoeconomic order function in a quantum process and therefore urges proper conceptualization through a quantum worldview. The quantum revolution long ago ended the dominance of classic Newtonian physics and classic materialism, generating what Murphy summarized as three courses especially relevant to international relations (hereinafter "IR"),[61] or human sciences in general:[62] the analogy course that uses quantum as metaphors to understand social order and is employed by most IR scholars;[63] the ontology course that investigates social structure as an actual quantum system at the ontological level and was proposed by Wendt, Pan, and O'Brien;[64] and the quantizing postcritique course developed by Zanotti that critically reviews other theories using quantum theories.[65] These courses allow me to reconcile cybersecurity protection with economic

[61] *See generally* Michael P. A. Murphy, *Quantising Post-Critique: Entangled Ontologies and Critical International Relations*, 49(1) MILLENNIUM J. INT'L STUD. 175 (2020).
[62] *See* Alexander Wendt, *Why IR Scholars Should Care About Quantum Theory, Part I: Burdens of Proof and Uncomfortable Facts*, 14(1) INT'L THEORY 119, 121 (2022).
[63] For example, James Der Derian & Alexander Wendt, *'Quantizing International Relations': The Case for Quantum Approaches to International Theory and Security Practice*, 51(5) SEC. DIALOGUE 399 (2020); Marcus Holmes, *Re-Evaluating Theory and Methods in Diplomatic History: Bringing in Psychology, Neuroscience, Micro-Sociology, and Quantum*, 1 DIPLOMATICA 19 (2019); JOHN KEANE, *Quantum Metaphors*, *in* POWER AND HUMILITY: THE FUTURE OF MONITORY DEMOCRACY 301 (2018); Ali Asghar Kazemi, *Quantum Politics: New Methodological Perspective*, 12(1) INT'L STUD. J. 89 (2015); James Der Derian, *Quantum Diplomacy, German–US Relations and the Psychogeography of Berlin*, 6(2) HAGUE J. DIPL. 373 (2011).
[64] *See generally* ALEXANDER WENDT, QUANTUM MIND AND SOCIAL SCIENCE: UNIFYING PHTSICAL AND SOCIAL ONTOLOGY (2015); Chengxin Pan, *Enfolding Wholes in Parts: Quantum Holography and International Relations*, 26 EUR. J. INT'L RELS. (SPEICAL ISSUE) 14 (2020); KAREN L. O'BRIEN, YOU MATTER MORE THAN YOU THINK: QUANTUM SOCIAL CHANGE FOR A THRIVING WORLD (2021).
[65] *See generally* LAURA ZANOTTI, ONTOLOGICAL ENTANGLEMENTS, AGENCY, AND ETHICS IN INTERNATIONAL RELATIONS: EXPLORING THE CROSSROADS (2019); Laura Zanotti, *The Moral Failure of the Quest for Certainty*, *in* QUANTUM INTERNATIONAL RELATIONS: A HUMAN SCIENCE FOR WORLD POLITICS 361 (James Der Derian & Alexander Wendt eds., 2022).

臺灣大學學術期刊論文

liberalization in international economic law by applying the quantizing geoeconomics theoretical framework. As I shall demonstrate hereafter, the application of quantizing geoeconomics in cybersecurity governance, which draws upon the scholarship of pragmatism, is not somewhere in the middle of the classical spectrum of optimism and pessimism but rather a parallel method. In other words, I do not select between contradictory assumptions that are inherently flawed; rather, this research chooses them all—by adopting quantizing geoeconomics as a complementary model instead of a substitute.

At issue is how the theoretical framework of quantizing geoeconomics might be applied to cybersecurity governance. Recall that a quantum worldview is adopted to conceptualize the IR theory of geoeconomics, which means that geoeconomics is the philosophical foundation that underpins our conceptualization of the irreconciliation between security protection and economic liberalization, whereas the quantum measurement and holism theories are meant to improve the conceptualization of this irreconciliation with the aim of proposing a more pluralistic, flexible, and open structure for international economic law.[66] The discussion of quantizing geoeconomics herein provides methodological clarifications on the three questions comprising the ideal-typical taxonomy for cybersecurity governance, as presented in Table 2. By applying quantum measurement theory on the analogical level, quantizing geoeconomics accords equal significance to the utility and disruptive potential of data-driven innovations by upholding the geoeconomics of innovations regarding question (1), acknowledges both the positive (economic and cooperative) and negative (political and competitive) possibilities of data-driven innovations in cybersecurity governance regarding question (2); and by employing quantum holism theory at the ontological level, leads to fundamentally pluralistic cybersecurity governance models within a data-driven geoeconomic order regarding question (3).

[66] *See* Li, *supra* note 6, at 30.

臺灣大學學術期刊資料庫

TABLE 2: Advancing Pragmatism Through Quantizing Geoeconomics

	Rationales	*Presentations*	***Solutions***
	(1) Whether innovations are value-neutral?	(2) Whether and when cybersecurity protection should outweigh economic liberalization or vice versa?	(3) How can data-driven economic convergence and cybersecurity concerns be reconciled?
Scholarship of Optimism	No, innovations are created to benefit humankind.	Predominated by neoliberalism, deeming cybersecurity protection scarcely outweighs economic liberalization in the whole process of economic development.	Reminiscently Pro-multilateralism: Advocate for rule-based multilateral governance models, such as the WTO system.
Scholarship of Pessimism	No, innovations are disruptive and uncontrollable; they are determined by, and tools for, political ideology, developed to pursue certain agendas.	Predominated by nationalism, deeming cybersecurity and national security protection are the priorities, especially in a data-driven economy.	Representatively Anti-multilateralism: Advocates for regional and bilateral governance models, such as CPTPP and PTAs, but views them as laboratories for advancing governance cooperation in a multilateral forum.

臺灣大學學術期刊資料庫

Scholarship of Pragmatism Through Quantizing Geoeconomics	No, innovations are inherently political—their creation contains values, goals, and compromises.	Predominated by geoeconomics, acknowledge both positive and negative probabilities of data-driven innovations in cybersecurity.	Deferential to national autonomy; advocate for prudent and pluralistic transnational cooperation and learning.

A. Geoeconomics of Innovations

As human inventions, data-driven breakthroughs are too important to be considered value neutral.[67] Even according to the classical optimistic and pessimistic scholarship of innovation, scientific and technological advancements are either extraordinarily advantageous for economic liberalization or unpredictably detrimental for structural and industrial stability and security. Contrary to the either-or assumption that overemphasizes one fixed reality, the method of quantizing geoeconomics offers a more reflective and useful perspective on data-driven innovations and the ability to have nuanced conversations about the purposes, risks, and uncertainties of such innovations for cybersecurity governance in the geoeconomic order.

Quantizing geoeconomics necessitates a recognition of what can be termed the geoeconomics of innovations, which is a crucial factor that has further exacerbated the frictions accompanying the digital transformation of the world economy, rendering legal principles of neoliberal and multilateral nature questionable. There are two implications that follow: first, all scientific and technological achievements are political at a constructivist level; and second, data-driven innovations may be used as strategic instruments of economic competitiveness. By "political", I do not mean that science or technologies represent or are driven by the political ideology of any particular government or party; rather, I build on the "politics of technologies" introduced by Schwab, who suggests that innovations are solutions that are developed in social processes by people and institutions who uphold a set of values, goals, and compromises that, in turn, affect power, structure and status within society.[68] In the context of a data-driven

[67] *See* Schwab & Davis, *supra* note 2, at 31.
[68] *See id.* at 32. *See generally* Kjersti Aalbu & Tore Longva, *From Progress to Delay: The Quest for Data in the Negotiations on Greenhouse Gases in the International Maritime Organization*, 22(2) GLOB. ENV'T POL. 136 (2022) (The "politics of data" that have constructivist functions during

臺灣大學學術期刊論文授權

economy, the creation, commercialization, and adoption of data-driven innovations are therefore contingent upon complex judgments involving values, principles, interests and compromises in all dimensions in which they may be involved, with the potential to alter power dynamics and strategic statuses in the global economic arena. What realizes and amplifies the political potential of innovations is the emergence of a geoeconomic order in which science and technology become undeniably serious geoeconomic strategies, [69] prompting experiments with new governance models that incorporate substantial, if not greater, geoeconomic considerations.

B. Possibilities in Cybersecurity Governance

The theoretical framework of quantizing geoeconomics, as established, presents geoeconomics as analogous to quantum measurement theory in the sense that geoeconomics, on the macro level, operates as a shared wave function (a total abstraction) with negative (competitive) and positive (cooperative) probabilities that collapse as a result of state practice that prioritize national or regional economic securities in governance.[70] Given that cybersecurity governance is susceptible to the broader geoeconomic order that I have quantized theoretically, the problem itself may be conceptualized by applying quantum measurement theory on the analogical level, presenting a new narrative that parallels the dualistic classification of scholarship on cybersecurity.

The new narrative of cybersecurity governance in the geoeconomic order developed by quantizing geoeconomics is based on Shaffer's scholarship of pragmatism, which argues for the significance of recognizing various possibilities of cybersecurity governance prior to proposing any

---

international organization negotiations has recently been analyzed); moreover, the political character of innovations has been recognized by scientists and technologists working on human-centric, values-based innovations. For example, see Sarah Dean et al., *Axes for Sociotechnical Inquiry in AI Research*, 2(2) IEEE TRANSACTIONS TECH. & SOC'Y 62, 62 (2021) (AI is labeled a "social-technical system" that calls for prudent thinking regarding its value); Peter Andras, et al., *Trusting Intelligent Machines: Deepening Trust Within Socio-Technical Systems*, 37(4) IEEE TECH. & SOC'Y MAG. 76 (2018). *See also* NUFFIELD COUNCIL ON BIOETHICS, EMERGING BIOTECHNOLOGIES: TECHNOLOGY, CHOICE AND THE PUBLIC GOOD 13 (2012) (Biotechnology is defined as a "conjunction of knowledge, practices, products, and applications" that come into being in a particular social and historical context.).

[69] *See* Kathleen Claussen et al., *Introduction to Volume 24, 2021*, 24(1) J. INT'L ECON. L. 1, 2 (2021); Shin-yi Peng et al., *Governing Science and Technology in the Era of Megaregionals*, *in* GOVERNING SCIENCE AND TECHNOLOGY UNDER THE INTERNATIONAL ECONOMIC ORDER: REDULATORY DIVERGENCE AND CONVIENCE IN THE AGE OF MEGAREGIONALS 3, 10-11 (Shin-yi Peng et al. eds., 2018); Mark Wu, *Export Policies, Technology Transfer Policies, and Investment Reviews: How States Compete in the Era of Global High-Tech Value Chains*, *in* GOVERNING SCIENCE AND TECHNOLOGY UNDER THE INTERNATIONAL ECONOMIC ORDER: REGULATORY DIVERGENCE AND CONVIENCE IN THE AGE OF MEGAREGIONALS 90, 91 (Shin-yi Peng et al. eds., 2018).

[70] *See* Li, *supra* note 6, at 21.

臺灣大學學術期刊資料庫

regulatory reforms or norm changes within the geoeconomic order.[71] Scientific and technological pragmatists acknowledge that there are indeed trade-offs.[72] They find that 4IR innovations are inexorably luring humans into unchartered territory, but there are a variety of possible governing options that concern not only pathologies but also pathogens that law can channel.[73] Thus, the task for scholars of innovation pragmatism is undeniably daunting: international economic law should manage emerging cybersecurity and national security risks through modest, resilient, and pluralistic governance models against the backdrop of a data-driven economy that exists during the 4IR and a paradigm shift to a geoeconomic order.

The task sets the parameters of the scholarship of pragmatism. Different from the persistence of optimistic scholarship in reforming multilateral governance to accommodate new security interests in a data-driven economy, a pragmatic stance contends that economic agreements should be deferential to national regulation, particularly when addressing issues manifesting the limitations of legalism in the geoeconomic order, such as cybersecurity and national security threats.[74] Meanwhile, such a stance supports regulatory experimentation and the adaptation and recalibration of cybersecurity and national security protection mechanisms at transnational levels with a focus on regulatory learning as an essential complement and alternative to the WTO rule-based model,[75] distinguishing such a methodology from the pessimistic scholarship that is torn between bilateral and multilateral approaches. Most of the time, the keyword in the literature on pragmatism is therefore balance: balance between free data flows and digital industrial policy or experimental data regulation;[76] balance between competing interests, such as creativity and essential security interests;[77] and

---

[71] *See* Shaffer, *supra* note 5, at 263.
[72] *See id.*
[73] Orly Lobel, *The Law of the Platform*, 101(1) MINN. L. REV. 87, 102 (2016). The law's channeling function has been well-demonstrated by legal theorists. *See* Leslie Green, *Introduction*, *in* THE CONCEPT OF LAW i, xv (Joseph Raz & Penelope A. Bulloch eds., 3d ed. 2012) (The function of law is to provide "facilities" and to express and channel social power.); SCOTT J. SHAPIRO, LEGALITY 119 (2011) (Law is viewed as "planning", helping to guide and evaluate conduct.); Lon L. Fuller, *Consideration and Form*, 41(5) COLUM. L. REV. 799, 801 (1941) (Legal frameworks such as forms offer channels for the legally effective expression of the intention behind an action.); K. N. Llewellyn, *The Normative, the Legal, and the Law-Jobs: The Problem of Juristic Method*, 49(8) YALE L.J. 1355, 1376 (1940) (The law's job is described as the preventive channeling and shifting of orientations, behaviors, attitudes, and expectations.).
[74] *See* Shaffer, *supra* note 5, at 275-77; Heath, *Trade and Security Among the Ruins*, *supra* note 5, at 258.
[75] *See* Shaffer, *supra* note 5, at 280-81; David Collins et al., *A Soft Landing for Developing Countries and Non-Discrimination in Digital Trade: Possible Lessons from Asian Countries*, 55(4) J. WORLD TRADE 649, 650 (2021); Heath, *Trade and Security Among the Ruins*, *supra* note 5, at 223; Meltzer, *supra* note 51, at S48.
[76] *See* Streinz, *supra* note 18, at 314.
[77] *See* Bryan Mercurio & Kuei-Jung Ni, *The Use of Science and Technology in International*

臺灣大學學術期刊資料庫

balance between understating cybersecurity as being easily regulated by traditional governance models and overstating the novelty of cyberspace as being exempted from general governance dynamics.[78] In a world of uncertainty and conjecture, the scholarship of pragmatism provides an analogical quantum observation that identifies various possibilities within cybersecurity governance amidst the havoc of transnational rivalry, insecurity, and distrust, laying the groundwork for the application of quantizing geoeconomics.

While pragmatism does identify various possibilities within cybersecurity governance in international economic law, it fails to address the broader context of the geoeconomic order, or more precisely, to alleviate the transnational environment of antagonism in today's data-driven economy, which perhaps is the pathogen for the pathology of techno-nationalism. This is where quantizing geoeconomics can play a complementary role, as it recognizes the cooperative possibilities of often missed or stigmatized cybersecurity-related measures. Geoeconomics is a pluralist field, manifesting itself in the cybersecurity domain. States can act competitively when prioritizing unilateral cybersecurity protection to realize and strengthen their political agenda without any clear economic prospects. Meanwhile, states can also act cooperatively when prioritizing bilateral or regional cybersecurity primarily for achieving economic goals rather than political influence.[79] Scholars and practitioners have largely disregarded the pluralistic nature of geoeconomics because cooperative measures in a data-driven economy could be misconstrued as competitive strategies designed to advance political agendas rather than achieve economic interests, thereby generating cybersecurity concerns and, consequently, protectionist measures.

For example, the US-China trade and tech war places science and technology at the center of a power competition since this competition will determine whether China or the United States will be the next global leader.[80] Therefore, China's advancement of industrial standards such as 5G infrastructure is deemed by the US, Europe, and Japan as a strategic plan to enable espionage, allow China to hold the economies of other nations hostage if wireless services are shut down, and even exploit system vulnerabilities, thus posing multidimensional security concerns. The US is also contesting China's 2025 innovation strategy partly because China is attempting to seize the lead in smart manufacturing, a cutting-edge technology that could be used for military objectives. In both instances,

Economic Law: An introduction, *in* SCIENCE AND TECHNOLOGY IN INTERNATIONAL ECONOMIC LAW: BALANCING COMPETING INTERESTS 1, 3 (Bryan Mercurio & Kuei J. Ni eds., 2013).

[78] *See* Martha Finnemore & Duncan B. Hollis, *Constructing Norms for Global Cybersecurity*, 110(3) AM. J. INT'L L. 425, 428 (2016).

[79] *See* Li, *supra* note 6, at 21-22.

[80] *See* Shaffer, *supra* note 5, at 266.

臺灣大學學術期刊資料庫

China's pursuit of both economic growth and political influence threatens US hegemony and the post-Cold War US-led international order, necessitating that the US and its allies enact unilateral measures such as the Clean Network Program[81] to maintain hegemonic stability.[82] As a result, China is considered to be engaging in a power struggle characterized by the "Thucydides trap", and the US-China conflict exemplifies competitive geoeconomics, in which both sides prioritize their political agendas above economic development.

However, this allegation lacks both theoretical validity and empirical proof. The practice of quantizing geoeconomics requires acknowledging the considerable complexity and nuance in a data-driven economy, indicating that geoeconomics is not inherently, monistically competitive but operates as a shared wave function with both cooperative and competitive potential, collapsing through states' practice and transnational interactions.[83] The fundamental objective for China's advancement in innovations and other cybersecurity-related measures may simultaneously be a long-term commitment to achieve common economic growth and a strategic plan to bolster political power. Since economic interests comprise at least a portion of its strategic objectives, China's dominant mindset in the data-driven economy is cooperative geoeconomics, which offers cooperative opportunities at bilateral, regional, and multilateral levels, as evidenced by China's behaviors in relevant dispute settlement processes. That is, during any type of war, cybersecurity-related measures, such as advancing science and technology, can have both weaponization (political) and welcome-mat (economic) effects, given that they are fundamental components of the geoeconomic order in which economic dominance and innovative independence become crucial to national security.[84] Negative assertions devoid of empirical evidence hinder a comprehensive understanding of cybersecurity in the geoeconomic order. Thus, quantizing geoeconomics is essential for emphasizing the probabilities involved in cybersecurity governance and recognizing the cooperative potential of cybersecurity-related measures in a geoeconomic order.

[81] *See The Clean Network*, U.S. DEP'T OF STATE, https://2017-2021.state.gov/the-clean-network/index.html (last visited Feb. 25, 2018).
[82] For US leadership and hegemonic stability theory, see ROBERT GILPIN, GLOBAL POLITICAL ECONOMY: UNDERSTANDING THE INTERNATIONAL ECONOMIC ORDER 84, 93-97 (2001).
[83] *See* Li, *supra* note 6, at 21.
[84] *See* Henry Farrell & Abraham L. Newman, *Weaponized Interdependence: How Global Economic Networks Shape State Coercion*, 44(1) INT'L SEC. 42, 70 (2019).

臺灣大學學術期刊資料庫

IV. PLURALISTIC RECONCILIATION BETWEEN (CYBER)SECURITY PROTECTION AND ECONOMIC LIBERALIZATION THROUGH QUANTIZING GEOECONOMICS

Quantizing geoeconomics on the ontological level reveals the holographical character of the geoeconomic order.[85] On the one hand, the parts (here, the many states' geoeconomic actions at the national, regional, and international levels) and the whole (the geoeconomic order) are almost identical to holographical characteristics, indicating that geoeconomics as a frame will wash out non-geoeconomic actions by states both by narrowing the room for reaching and forcing multilateral agreements and through entanglements between essential parts, such as the US-China rivalry. On the other hand, the parts and the whole are not identical to each other, requiring the reconceptualization of the parts in the whole with holographic characteristics through active, dominant, and reverse geoeconomic modes from passive to active. I concluded that quantizing geoeconomics as an ontology reveals that the challenges caused by emerging geoeconomics should be systematically addressed at international, regional, and national levels.

Adopting the method of quantizing geoeconomics on the ontological level in cybersecurity governance suggests that the reconciliation between cybersecurity and economic liberalization requires pluralistic regulatory models manifesting shared values at international, regional, and national levels. In this section, I reflect upon three implications of quantizing geoeconomics: how to reframe international economic law as a pluralistic regulatory model to govern (cyber)security risks in a data-driven economy; whether certain pluralistic regulatory model under quantizing geoeconomics would generate normative payoffs; and lastly, how to counteract the unpredictability and instability through the modelling of quantizing geoeconomics in security protection within the settings of international economic law.

A. Establish Pluralistic Governance Model

The construction of a pluralistic governance model for new challenges, such as cybersecurity threats, in the data-driven economy first rests upon the change in how one generally frames international economic law in the geoeconomic order. The ontological conclusion of quantizing geoeconomics is a geoeconomic order with a holographical character in the sense that the whole (here, the geoeconomic order) is approximately present in the parts (the many states' geoeconomic actions at the national, regional, and

[85] *See* Li, *supra* note 6, at 26.

臺灣大學學術期刊資料庫

international levels),[86] and yet, simultaneously, the parts do not mirror the whole all the time and are inherently entangled and mutually implicated.[87] This theoretical framework defines two sets of relationships in governing cybersecurity issues in a data-driven economy, aiding what Shaffer calls modest and resilient international economic law.[88]

The first relationship is between the geoeconomic order (the whole) and international economic law, or more precisely, numerous national, bilateral, regional and international regulatory models, including cybersecurity or national security protection provisions (the parts). The holographical character of geoeconomics indicates that security provisions and mechanisms at various levels are promulgated or negotiated within the geoeconomic order, replicating the broader geoeconomic context that prioritizes national security protection but also possesses cooperative possibilities, despite their legalistic nature. In other words, international economic law generally cannot function without a broader regulatory ecosystem that encompasses at least political, economic, and legal considerations of geoeconomics, among other emerging paradigms.[89] Any "ambitious" agreements on cybersecurity risks that are fixed on economic liberalization and that provide no flexibility on security-related issues would be problematic at this stage.

The second relationship is between various regulatory models (the parts) within the geoeconomic holography, which include not only domestic regulations and transnational agreements of trade and investment but also other regulatory models such as regulatory cooperation, [90] mutual recognition,[91] and multistakeholder approaches.[92] Due to the fragmentation and evolution of international economic law stimulated by the shifting global order,[93] cybersecurity risks in the data-driven economy cannot rely solely on traditional international law models such as agreements or treaties, nor can they be regulated exclusively by hard law or soft law norms. Instead, more flexibility should be granted in (cyber)security protection,[94] as international

[86] *See id.* at 23.
[87] Pan, *supra* note 64, at 19; WENDT, *supra* note 64, at 269.
[88] *See generally* Shaffer, *supra* note 5.
[89] *See id.* at 270-71.
[90] *See generally* Gao & Zhou, *supra* note 4.
[91] *See generally* Ahmed, *supra* note 45.
[92] *See generally* Peng, *supra* note 31.
[93] *See generally* Tamar Megiddo, *Beyond Fragmentation: On International Law's Integrationist Forces*, 44(1) YALE J. INT'L L. 115 (2019) ("Fragmentation" here is not negatively understood as an untenable dilemma faced by states, described in the mainstream literature as inducing conflicting instructions from multiple international legal regimes that require states to violate the binding norms of one regime to comply with another and ultimately undermine international law's coherence and authority. Instead, we agree that fragmentation in the geoeconomic order may serve as a catalyst for states to experiment with creative approaches to reconcile their international obligations with their domestic agendas.).
[94] *See* Gregory Shaffer, *Governing the Interface of U.S.-China Trade Relations*, 115(4) AM. J. INT'L

臺灣大學學術期刊資料庫

economic law is a new creation fostered by entanglements between different parts (in this case, the various types of regulations, agreements, and regulatory models) that are comprised of legally binding hard law norms and flexible soft law norms developed transnationally in response to emerging geoeconomic possibilities. At its core, quantizing geoeconomics suggests that a broader ecology of national security governance be acknowledged and that there should be no one set of hierarchical rules; it also encourages states to experiment with pluralistic regulatory approaches to govern (cyber)security in the data-driven economy within today's geoeconomic order.

B. Identify National Autonomy as Governance Anchor

If there is no single system of hierarchical rules and states use regulatory sandboxes to gain governance experience and develop alternative models to protect a variety of essential security interests in the data-driven economy, then the question becomes the following: can security-related international economic law generate normative payoffs? More fundamentally, for the theoretical framework of quantizing geoeconomics, how could one understand the collapse of geoeconomic wave function that follows the uncertainty principle[95] in international law where one allegedly has to assume a fully deterministic image of human existence?[96] In particular, what is justice or fairness in (cyber)security protection if every regulatory model is subordinated to a holographical geoeconomic wave function that could result in negative (competitive) or positive (cooperative) outcomes depending on different states' strategies?

Recalling the two uncomfortable facts about classical optimistic and pessimistic scholarship for a moment, one must acknowledge here that the shoe is on the other foot: before I reach to the quantizing geoeconomics framework, which suggests a pluralistic governance model, its classical equivalents already present swing votes on the same spectrum, which has severe normative issues. The reason is obvious: when neoliberal anomalies such as protectionism and regionalism become prevalent, the neoliberal and multilateral international economic order is unable to adequately address new legal disputes with a political nature, and no classical theory is available to deal with such persistent anomalies. The theoretical framework of quantizing geoeconomics, which advocates for a pluralistic governance model for the (cyber)security issues that appear in a data-driven economy, may be insufficient on its own, but it at least helps complement classical

L. 622, 655 (2021).

[95] *See* Der Derain & Wendt, *supra* note 63, at 406.

[96] *See* MARTTI KOSKENNIEMI, FROM APOLOGY TO UTOPIA: THE STRUCTURE OF INTERNATIONAL LEGAL ARGUMENT 557 (2006).

臺灣大學學術期刊資料庫

theories by providing a parallel pragmatistic understanding, as opposed to ignoring, dismissing, reducing, or reinterpreting new situations. In constructing a pluralistic regulatory model for cybersecurity and national security risks in a data-driven economy within the geoeconomic order, the question becomes whether one can identify any legalistic and formalistic objectives and values as governance anchors in the formulation, interpretation, and application of international economic law.

This brings us to refute a critique of the fundamental logic of employing quantum theories in IR and international law—that goes, quantum theories negate common values such as justice and fairness when their existence is non-deterministic and dependent on observation.[97] Indeed, the method of quantizing geoeconomics adopts quantum holism theory on the ontological level and suggests regulatory experiments of all types with pluralistic geoeconomic possibilities whose outcomes vary according to different perspectives. This method's results will depend on the actors involved: what their focus is and why; what the prevailing political, economic, and legal frameworks are; what the domestic and transnational status quo is; what the historical context is; and many other factors that may vary considerably. In a rapidly evolving digital world subject to geoeconomics, quantizing geoeconomics seems, if anything, more like a precondition than a total fallacy. What needed to be incorporated as the anchor to counteract regulatory uncertainty and generate normative payoffs in a geoeconomic order is standard-setting on a voluntary, soft-law basis at the transnational level, which would significantly depend on states' consensuses or, in other words, on national autonomy.[98]

In economic-(cyber)security dispute settlement, for instance, the careful balance between (cyber)security protection and economic liberalization requires the acknowledgment that political sensitivity is an integral part of (cyber)security protection in international economic law in the era of geoeconomics. Formal and informal deference to national autonomy should be deemed as an approach toward pluralistic reconciliation rather than the politicization of international economic law. This entails three practical implications for dealing with cybersecurity measures that restrict digital economic liberalization. First, given that the majority of cybersecurity measures do not fall within the exceptional circumstances listed in security exceptions incorporated in multilateral trade agreements,[99] states should

[97] *See* Fred Chernoff, *'Truth', 'Justice', and the American Wave… Function: Comments on Alexander Wendt's Quantum Mind and Social Science*, 14(1) INT'L THEORY 146, 155 (2022).
[98] *See* Shin-yi Peng, *The Uneasy Interplay Between Digital Inequality and International Economic Law*, 33(1) EUR. J. INT'L L. 205, 233 (2022).
[99] *See* General Agreement on Tariffs and Trade art. 21, Oct. 30, 1947, 64 U.N.T.S. 187 [hereinafter GATT]; General Agreement on Trade in Services art. 14, Apr. 15, 1994, 1869 U.N.T.S. 183. Both of which were not drafted with cybersecurity considerations. Even though some may argue that GATT Article XXI(b)(ii) could be interpreted by the panel to cover cybersecurity issues, as the

臺灣大學學術期刊

seek alternative dispute settlement methods via diplomacy or regulatory cooperation frameworks, treating international formal dispute settlement mechanisms as the last resort.[100] Second, for foreign investments that are arbitrarily prohibited or phased out by national security screening mechanisms on the grounds of cybersecurity,[101] investors must resort to domestic-formal, domestic-informal, and international-informal remedies prior to seeking recourse through investor-state dispute settlement mechanisms incorporated in international investment agreements.[102] Third, in deciding cybersecurity measures, international judicial bodies must establish consistent and harmonious legal analytical standards and make reference to innovative scholarship, rendering decisions that do not create bifurcations between law on paper and law in practice, accord equal significance to legalism and realism in a geoeconomic order, and facilitate the renewed discussion of the reconciliation between (cyber)security protection and economic liberalization.

C. Achieve Homeostasis Through Regulatory Coordination

In a world of increased geoeconomic competitiveness and national security reassertion, or, as Thomas called these, "multipolarity and reterritorialization",[103] there are limitations to what a pluralistic governance model anchored by national autonomy can accomplish. The national autonomy of states acting under competitive geoeconomics as opposed to cooperative geoeconomics can be a gateway to nationalism and protectionism, ultimately inducing the deterioration of the rule of law in regard to international trade and investment.[104] To reconcile (cyber)security

provision justifies measures "relating to the traffic in arms, ammunition and implements of war and to such traffic in other goods and materials as is carried on directly or indirectly for the purpose of supplying a military establishment." Nonetheless, as I have established in Part II, cybersecurity extends well beyond supplies to "a military establishment".

[100] *See* Mishra, *supra* note 7, at 590.

[101] For an example, see *Huawei Technologies Co., Ltd. v. Kingdom of Sweden (ICSID Case No. ARB/22/2)*, UNCTAD INV'T POL'Y HUB, https://investmentpolicy.unctad.org/investment-dispute-settlement/cases/1208/huawei-v-sweden (last visited Mar. 8, 2023). The claim concerns with measures to preclude Huawei's 5G equipment and services on grounds of Swedish national security, adopted through the Swedish Post and Telecom Agency (PTS) and, at the minimum, the Swedish Security Service and the Swedish Armed Forces. The Huawei's legal challenge of the Swedish prohibition marks Chinese investors' proactive position on seeking legal remedies and, ultimately fairness, justice, and business opportunities, in the face of offensive and discriminatory national security screening mechanisms on issues in a digital economy.

[102] The typology is established on two dimensions—formal versus informal and domestic versus international. *See generally* Ji Li, *In Pursuit of Fairness: How Chinese Multinational Companies React to U.S. Government Bias*, 62(2) HARV. INT'L L.J. 375 (2021).

[103] *See generally* Chantal Thomas, *Trade and Development in an Era of Multipolarity and Reterritorialization*, 44 YALE J. INT'L L. ONLINE 77 (2019).

[104] *See generally* Gregory Shaffer, *A Tragedy in the Making? The Decline of Law and the Return of Power in International Trade Relations*, 44 YALE J. INT'L L. ONLINE 37 (2019).

臺灣大學學術期刊資料庫

with economic liberalization in international economic law in a geoeconomic order, regulatory learning, adaptation, and coordination are required to achieve a certain degree of homeostasis.

The term homeostasis, coined by US physiologist Walter Bradford Cannon in 1926, refers to the quality of a system in which variables are regulated to maintain stable and relatively constant internal conditions.[105] All homeostatic control systems contain at least three components for the variable being regulated: a receptor to monitor and respond to changes in the condition, an effector to alter the condition and restore it to its normal state, and a negative feedback mechanism between the two. Although the term homeostasis is typically used in biology to describe the internal physical and chemical conditions maintained by living organisms, it is an appropriate phrase to use when constructing a pluralistic governance model for national security through the method of quantizing geoeconomics in international economic law. The change in circumstances is the paradigm shift from neoliberalism to geoeconomics, and national autonomy is thus the receptor that detects and reacts to such a change by modifying policy and law-making priorities on national and transnational scales. A pluralistic governance model would serve as the effector, but rather than reverting the geoeconomic order to the previous neoliberal paradigm per se, it aims to create an inclusive environment for national security protection to promote the sustainable development of international economic law in the face of geoeconomic challenges—a "normal state" in another sense. Then, what is lacking is the feedback loop, which may be produced by regulatory learning, adaptation, coordination, and collaboration regarding (cyber)security issues through a model of pluralistic governance. Achieving homeostasis on (cyber)security governance would benefit the further updating and reforming of economic-security rules and policies, making international economic law to be resilient enough to balance the competing interests of protecting genuine (cyber)security interest and address political-sensitive issues with ample legalist and realist considerations.

Regulatory learning, adaptation, and coordination can be facilitated by developing new oversight and review mechanisms among international organizations to strengthen networks of interconnected institutional supervision over and peer review of national security concerns.[106] The pluralistic governance models of international economic law might also require the deployment of domestic due process mechanisms, including risk assessments, justification, and participation.[107] The implementation of these provisions could be subject to transnational peer review mechanisms by

[105] *See generally* WALTER B. CANNON, THE WISDOM OF THE BODY (1963).
[106] *See* Shaffer, *supra* note 5, at 271.
[107] For institutional alternative choices, see Gregory Shaffer & Joel Trachtman, *Interpretation and Institutional Choice at the WTO*, 52(1) VA. J. INT'L L. 103, 144, 149-52 (2011).

臺灣大學學術期刊資料庫

international institutions, coupled with process-oriented judicial reviews via dispute settlement mechanisms—solutions that highlight the significance of rethinking the balance between politics and adjudication.[108] Regardless of the approaches used to enhance international deliberation, cooperation, and coordination, the baseline requirements for regulatory learning and coordination on national security issues are that international institutions must not overreach their prerogative and that international economic law should not preclude domestic debates and decisions regarding what are considered states' essential interests.

V. CONCLUSION

This article aims to demonstrate the theoretical implications of the theoretical framework of quantizing geoeconomics: this framework supplements the dualistic classification of optimistic and pessimistic scholarship and provides a parallel approach to pluralistically reconcile (cyber)security with economic liberalization within the geoeconomic order. To do so, the article initially introduces the growing cybersecurity challenges brought about by the interconnected, interdependent, and continuously developing data-driven innovations during the 4IR. Recognizing the formation of a buyer's market for the literature on cybersecurity governance, this article describes two uncomfortable facts about the dualistic classification of optimistic and pessimistic scholarship, which are analyzed through an ideal-typical taxonomy established by distinguishing three issues that cybersecurity governance essentially relies on: (1) whether innovations are value-neutral; (2) whether and when cybersecurity protection should trump economic liberalization or vice versa; and (3) how data-driven economic convergence can be reconciled with cybersecurity concerns. The two uncomfortable facts—one is the inability of optimistic methods to implement enforceable binding norms to prevent techno-nationalism by restructuring and revitalizing the WTO multilateral system, and the other is the inability of pessimistic methods to be self-sustaining without moving toward the multilateral governance model or any models with a greater degree of regulatory cooperation—are referred to as swing votes on a binary spectrum of pro- or anti-multilateralism. These are among the reasons I experiment with a parallel narrative—quantizing geoeconomics in (cyber)security governance—that is complementary rather than a replacement.

The application of quantizing geoeconomics in cybersecurity governance highlights the geoeconomics of innovations and cybersecurity governance possibilities based upon a quantum measurement analogy,

[108] *See* Heath, *The New National Security Challenge to the Economic Order*, *supra* note 5, at 1027, 1096.

臺灣大學學術期刊資料庫

leading to three proposals to reconcile (cyber)security concerns with economic liberalization that builds upon quantum holographic ontology. By establishing a pluralistic governance model, this article advocates that a broader ecology of (cyber)security governance be recognized and that there should be no single set of hierarchical rules, which can thereby encourage states to experiment with pluralistic regulatory approaches to govern the data-driven economy in today's geoeconomic order. By defining national autonomy as the governance anchor in rulemaking and dispute settlement, which is deemed as an approach toward pluralistic reconciliation rather than the politicization of international economic law, this article hopes to produce the normative rewards and practical implications of quantizing geoeconomics for economic-security issues in a geoeconomic order. It timely responds to the criticism that quantum theories in IR and international law are devoid of profound and concrete impact. Last, it argues that regulatory learning, adaptation, and coordination at the national and transnational levels might help attain a degree of homeostasis in (cyber)security governance in international economic law. Overall, through quantizing postcritique course, this article demonstrates how quantizing geoeconomics can be applied to critically review existing scholarship on (cyber)security issues, highlighting what quantizing geoeconomics can add to the classical scholarship of (cyber)security governance to pursue a pluralistic reconciliation between security protection and economic liberalization in international economic law in an age of geoeconomics.

Despite my attempt to advance the theoretical framework of quantizing geoeconomics through the quantizing postcritique course, specifically on the conceptualization of cybersecurity governance in a data-driven economy during the 4IR, there are admittedly clear limits to this approach. At the forefront is the lack of practical implications on specific security issues in dispute settlement. Rather than investigating the interpretation and application of exception clauses of international, regional, and bilateral agreements invoked in cybersecurity cases, this research uses cybersecurity as the laboratory to examine insufficiencies of the dualistic classification of scholarship on conceptualizing novel security challenges brought about by the data-driven economy. In other words, my experimentation of quantizing geoeconomics does not attempt to make new interpretations of the law itself to fill the gaps in practice and/or apply law to a pressing practical problem at hand (which are the mainstream approaches of doctrinal methodology), but to explain how the making of legal interpretations or reforms in the geoeconomic order is possible (which incorporates conceptual legal research and critical legal studies into doctrinal methodology). It seeks to make explicit the conceptual narrative that controls the production of the humble, pluralistic reconciliation in the making, interpretation, and application of security-related exceptions in international economic law, which seems

臺灣大學學術期刊資料庫

impossible under classical scholarship. For this reason, perhaps instead of calling them limitations, I should conceptualize them as unknowns to align this experiment with a quantum worldview in international economic law. It is unknown yet whether the practical implications for international economic law could be truly realized in dispute settlement. It is also unknown yet whether the nascent method of quantizing geoeconomics is applicable to profound global crises arising from ecological tipping points and the inequitable distribution of energy resources within a finite and fragile planet. These unknowns are what I, and fellow scholars in international law and IR, strive to explore in endeavors onward.

The advisability of quantum something in international law is indeed skeptical in many ways, but as Wendt remarks, for any quantum theorist, there is no one objective truth to be defended, only multiple perspectival ones.[109] What I see within quantizing geoeconomics are efforts to reframe international economic law to incorporate some unique aspects of the quantum worldview, such as the probabilities of measurement and holographic ontology. This method poses no threat to classical scholarship on international economic law but offers a possible parallel narrative and operates as a question rather than an answer. Hence, this method is "exploratory" realism or "open" realism. As an interdisciplinary framework for navigating international economic law (cybersecurity governance), international relations (geoeconomics and quantum IR), and quantum theories, quantizing geoeconomics cannot thrive without rigorous and relentless interrogations and experimentation. As it develops, "quantum legal theory" may just adapt international economic law to the modern world and expand its outreach, making novel and fruitful contributions to philosophical and practical debates in international law.

[109] *See* Alexander Wendt, *Why IR Scholars Should Care About Quantum Theory, Part II: Critics in the PITs*, 14(1) INT'L THEORY 193, 200 (2022).

臺灣大學學術期刊資料庫

REFERENCES

Books

CHOUCRI, NAZLI & DAVID D. CLARK (2018), INTERNATIONAL RELATIONS IN THE CYBER AGE: THE CO-EVOLUTION DILEMMA.

GILPIN, ROBERT (2001), GLOBAL POLITICAL ECONOMY: UNDERSTANDING THE INTERNATIONAL ECONOMIC ORDER.

KNAKE, ROBERT K. (2010), INTERNET GOVERNANCE IN AN AGE OF CYBER INSECCURITY.

KOSKENNIEMI, MARTTI (2006), FROM APOLOGY TO UTOPIA: THE STRUCTURE OF INTERNATIONAL LEGAL ARGUMENT.

MCCRAW, THOMAS K. (2010), PROPHET OF INNOVATION: JOSEPH SCHUMPETER AND CREATIVE DESTRUCTION.

NEW YORK STOCK EXCHANGE GOVERNANCE SERVICES (2015), NAVIGATING THE DIGITAL AGE: THE DEFINITIVE CYBERSECURITY GUIDE FOR DIRECTORS AND OFFICERS.

NUFFIELD COUNCIL ON BIOETHICS (2012), EMERGING BIOTECHNOLOGIES: TECHNOLOGY, CHOICE AND THE PUBLIC GOOD.

O'BRIEN, KAREN L. (2021), YOU MATTER MORE THAN YOU THINK: QUANTUM SOCIAL CHANGE FOR A THRIVING WORLD.

ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (2015), DATA-DRIVEN INNOVATION: BIG DATA FOR GROWTH AND WELL-BEING.

Schmitt, Michael N. & Liis Vihul (eds.) (2017), TALLINN MANUAL 2.0 ON THE INTERNATIONAL LAW APPLICABLE TO CYBER OPERATIONS, 2d ed.

SCHUMPETER, JOSEPH A. (2010), CAPITALISM, SOCIALISM AND DEMOCRACY, Harper & Brothers (1942).

SCHWAB, KLAUS (2017), THE FOURTH INDUSTRIAL REVOLUTION.

SCHWAB, KLAUS & NICHOLAS DAVIS (2018), SHAPING THE FUTURE OF THE FOURTH INDUSTRIAL REVOLUTION: A GUIDE TO BUILDING A BETTER WORLD.

SHAPIRO, SCOTT J., LEGALITY (2011).

SUSSKIND, JAMIE (2018), FUTURE POLITICS: LIVING TOGETHER IN A WORLD TRANSFORMED BY TECH.

WENDT, ALEXANDER (2015), QUANTUM MIND AND SOCIAL SCIENCE: UNIFYING PHTSICAL AND SOCIAL ONTOLOGY.

ZANOTTI, LAURA (2019), ONTOLOGICAL ENTANGLEMENTS, AGENCY, AND ETHICS IN INTERNATIONAL RELATIONS: EXPLORING THE CROSSROADS.

Articles

Aalbu, Kjersti & Tore Longva (2022), *From Progress to Delay: The Quest for Data in the Negotiations on Greenhouse Gases in the International Maritime Organization*, 22(2) GLOBAL ENVIRONMENTAL POLITICS 136.

臺灣大學學術期刊資料庫

Aaronson, Susan Ariel (2018), *What Are We Talking About When We Talk About Digital Protectionism?*, 18(4) WORLD TRADE REVIEW 541.

Aaronson, Susan Ariel (2021), *Data Is Different, So Policymakers Should Pay Close Attention to Its Governance*, *in* BIG DATA AND GLOBAL TRADE LAW 340, (Mira Burri ed.).

Abendin, Simon & Pingfang Duan (2021), *Global E-Commerce Talks at the WTO: Positions on Selected Issues of the United States*, *European Union, China, and Japan*, 20(5) WORLD TRADE REVIEW 707.

Ahmed, Usman (2019), *The Importance of Cross-Border Regulatory Cooperation in an Era of Digital Trade*, 18 WORLD TRADE REVIEW (SPEICAL ISSUE) 99.

Andras, Peter, et al. (2018), *Trusting Intelligent Machines: Deepening Trust Within Socio-Technical Systems*, 37(4) IEEE TECHNOLOGY AND SOCIETY MAGAZINE 76.

Burri, Mira (2019), *Understanding and Shaping Trade Rules for the Digital Era*, *in* THE SHIFTING LANDSCAPE OF GLOBAL TRADE GOVERNANCE: WORLD TRADE FORUM 73 (Manfred Elsig et al. eds.).

Burri, Mira (2021), *Data Flows and Global Trade Law*, *in* BIG DATA AND GLOBAL TRADE LAW 11 (Mira Burri ed.).

Burri, Mira (2021), *Towards a New Treaty on Digital Trade*, 55 JOURNAL OF WORLD TRADE 77.

Chander, Anupam & Uyên P. Lê (2015), *Data Nationalism*, 64(3) EMORY LAW JOURNAL 677.

Chernoff, Fred (2022), *'Truth', 'Justice', and the American Wave… Function: Comments on Alexander Wendt's Quantum Mind and Social Science*, 14(1) INTERNATIONAL THEORY 146.

Claussen, Kathleen et al. (2021), *Introduction to Volume 24, 2021*, 24(1) JOURNAL OF INTERNATIONAL ECONOMIC LAW 1.

Collins, David et al. (2021), *A Soft Landing for Developing Countries and Non-Discrimination in Digital Trade: Possible Lessons from Asian Countries*, 55(4) JOURNAL OF WORLD TRADE 649.

Dean, Sarah et al. (2021), *Axes for Sociotechnical Inquiry in AI Research*, 2(2) IEEE TRANSACTIONS ON TECHNOLOGY AND SOCIETY 62.

Der Derian, James (2011), *Quantum Diplomacy, German–US Relations and the Psychogeography of Berlin*, 6(2) THE HAGUE JOURNAL OF DIPLOMACY 373.

Der Derian, James & Alexander Wendt (2020), *'Quantizing International Relations': The Case for Quantum Approaches to International Theory and Security Practice*, 51(5) SECURITY DIALOGUE 399.

Elsig, Manfred et al. (2019), *Introduction: Current Challenges and Future Scenarios*, *in* THE SHIFTING LANDSCAPE OF GLOBAL TRADE GOVERNANCE: WORLD TRADE FORUM 1 (Manfred Elsig et al. eds.).

臺灣大學學術期刊資料庫

Farrell, Henry & Abraham L. Newman (2019), *Weaponized Interdependence: How Global Economic Networks Shape State Coercion*, 44(1) INTERNATIONAL SECURITY 42.

Ferracane, Martina F. (2021), *The Costs of Data Protectionism*, *in* BIG DATA AND GLOBAL TRADE LAW 63 (Mira Burri ed.).

Finnemore, Martha & Duncan B. Hollis (2016), *Constructing Norms for Global Cybersecurity*, 110(3) AMERICAN JOURNAL OF INTERNATIONAL LAW 425.

Flowers, Betty Sue (2018), *Technology and Humanity in the Fourth Industrial Revolution*, 72(1) JOURNAL OF INTERNATIONAL AFFAIRS 179 (reviewing KLAUS SCHWAB & NICHOLAS DAVIS, SHAPING THE FOURTH INDUSTRIAL REVOLUTION (2018)).

Fuller, Lon L. (1941), *Consideration and Form*, 41(5) COLUMBIA LAW REVIEW 799.

Gagliani, Gabriele (2020), *Cybersecurity, Technological Neutrality, and International Trade Law*, 23(3) JOURNAL OF INTERNATIONAL ECONOMIC LAW 723.

Gao, Henry & Weihuan Zhou (2021), *Governing Science and Technology Under the International Economic Order: Regulatory Divergence and Convergence in the Age of Megaregionals* by Shin-yi Peng, Han-Wei Liu and Ching-Fu Lin Edward Elgar Publishing, 2018, 20(3) WORLD TRADE REVIEW 369 (book review).

Green, Leslie (2012), *Introduction*, *in* THE CONCEPT OF LAW i (Joseph Raz & Penelope A. Bulloch eds., 3d ed.).

Gur, Berna Akcali (2021), *Restrictions on Trade in Telecommunications: WTO's Cybersecurity Conundrum*, 55(3) JOURNAL OF WORLD TRADE 477.

Hahn, Michael (2019), *For Whom the Bell Tolls: The WTO's Third Decade*, *in* THE SHIFTING LANDSCAPE OF GLOBAL TRADE GOVERNANCE: WORLD TRADE FORUM 121 (Manfred Elsig et al. eds.).

Heath, J. Benton (2020), *The New National Security Challenge to the Economic Order*, 129(4) THE YALE LAW JOURNAL 1020.

Heath, J. Benton (2020), *Trade and Security Among the Ruins*, 30(2) DUKE JOURNAL OF COMPARATIVE & INTERNATIONAL LAW 223.

Holmes, Marcus (2019), *Re-Evaluating Theory and Methods in Diplomatic History: Bringing in Psychology, Neuroscience, Micro-Sociology, and Quantum*, 1 DIPLOMATICA 19.

Hu, Jia-Xiang (2013), *When Trade Encounters Technology: The Role of the Technological Neutrality Principle in the Development of WTO Rules*, *in* SCIENCE AND TECHNOLOGY IN INTERNATIONAL ECONOMIC LAW: BALANCING COMPETING INTERESTS 75 (Bryan Mercurio & Kuei-Jung Ni eds.).

臺灣大學學術期刊資料庫

Huang, Keman et al. (2021), *A Systematic Framework to Understand Transnational Governance for Cybersecurity Risks from Digital Trade*, 12(5) GLOBAL POLICY 625.

Kanevskaia, Olia (2022), *ICT Standards Bodies and International Trade: What Role for the WTO?*, 56(3) JOURNAL OF WORLD TRADE 429.

Kazemi, Ali Asghar (2015), *Quantum Politics: New Methodological Perspective*, 12(1) INTERNATIONAL STUDIES JOURNAL 89.

KEANE, JOHN (2018), *Quantum Metaphors*, *in* POWER AND HUMILITY: THE FUTURE OF MONITORY DEMOCRACY 301.

Keitner, Chimene I. & Harry L. Clark (2019-2020), *Cybersecurity and Trade Agreements: The State of the Art*, 10 HARVARD BUSINESS LAW REVIEW ONLINE 1.

KEYNES, JOHN MAYNARD (2013), *Economic Possibilities for Our Grandchildren (1930)*, *in* 9 THE COLLECTED WRITINGS OF JOHN MAYNARD KEYNES: IX ESSAYS IN PERSUASION 321 (Elizabeth Johnson & Donald Moggridge eds.).

Kingsbury, Benedict et al. (2019), *Introduction: The Essence, Significance, and Problems of the Trans-Pacific Partnership*, *in* MEGAREGULATION CONTESTED: GLOBAL ECONOMIC ORDERING AFTER TPP 1 (Benedict Kingsbury et al. eds.).

Kingsbury, Benedict et al. (2019), *The Trans-Pacific Partnership as Megaregulation*, *in* MEGAREGULATION CONTESTED: GLOBAL ECONOMIC ORDERING AFTER TPP 27 (Benedict Kingsbury et al. eds.).

Korinek, Anton & Joseph E. Stiglitz (2019), *Artificial Intelligence and Its Implications for Income Distribution and Unemployment*, *in* THE ECONOMICS OF ARTIFICIAL INTELLIGENCE: AN AGENDA 349 (Ajay Agrawal et al. eds.).

Kwak, Dongchul (2022), *No More Strategical Neutrality on Technological Neutrality: Technological Neutrality as a Bridge Between the Analogue Trading Regime and Digital Trade*, 21(1) WORLD TRADE REVIEW 18.

Lacey, Simon B.C. (2020), *Reality Check: The Lack of Consensus on New Trade Rules to Govern the Digital Economy*, 54(2) JOURNAL OF WORLD TRADE 199.

Leonard, Thomas C. (2009), *Redeemed by History*, 17(1) HISTORY OF ECONOMIC IDEAS 189.

Li, Ji (2021), *In Pursuit of Fairness: How Chinese Multinational Companies React to U.S. Government Bias*, 62(2) HARVARD INTERNATIONAL LAW JOURNAL 375.

Li, Xinyue (2022), *Quantizing Geoeconomics: Emerging Geoeconomics in International Economic Law Under a Quantum Worldview*, 17(1) ASIAN JOURNAL OF WTO & INTERNATIONAL HEALTH LAW AND POLICY 5.

Liu, Han-Wei (2018), *China Standard Time: The Boundary of Techno-Nationalism in Megaregionals*, *in* GOVERNING SCIENCE AND

臺灣大學學術期刊資料庫

TECHNOLOGY UNDER THE INTERNATIONAL ECONOMIC ORDER: REGULATORY DIVERGENCE AND CONVERGENCE IN THE AGE OF MEGAREGIONALS 114 (Shin-yi Peng et al. eds.).

Llewellyn, K. N. (1940), *The Normative, the Legal, and the Law-Jobs: The Problem of Juristic Method*, 49(8) THE YALE LAW JOURNAL 1355.

Lobel, Orly (2016), *The Law of the Platform*, 101(1) MINNESOTA LAW REVIEW 87.

Louka, Elli (2021), *The New Trade Order: Conflicts, Internet Standards and Human Security*, 55(6) JOURNAL OF WORLD TRADE 921.

Mavroidis, Petros C. (2018), *Regulatory Cooperation in the WTO: Why It Matters Now? How Could It Be Achieved?*, *in* GOVERNING SCIENCE AND TECHNOLOGY IN THE ERA OF MEGAREGIONALS 12 (Shin-Yi Peng et al. eds.).

Megiddo, Tamar (2019), *Beyond Fragmentation: On International Law's Integrationist Forces*, 44(1) YALE JOURNAL OF INTERNATIONAL LAW 115.

Meltzer, Joshua P. (2019), *Governing Digital Trade*, 18(1) WORLD TRADE REVIEW (SPECIAL ISSUE) S23.

Mercurio, Bryan & Kuei-Jung Ni (2013), *The Use of Science and Technology in International Economic Law: An introduction*, *in* SCIENCE AND TECHNOLOGY IN INTERNATIONAL ECONOMIC LAW: BALANCING COMPETING INTERESTS 1 (Bryan Mercurio & Kuei J. Ni eds.).

Mishra, Neha (2019), *Privacy, Cybersecurity, and GATS Article XIV: A New Frontier for Trade and Internet Regulation?*, 19(3) WORLD TRADE REVIEW 341.

Mishra, Neha (2020), *The Trade: (Cyber)Security Dilemma and Its Impact on Global Cybersecurity Governance*, 54(4) JOURNAL OF WORLD TRADE 567.

Mitchell, Andrew D. & Neha Mishra (2019), *Regulating Cross-Border Data Flows in a Data-Driven World: How WTO Law Can Contribute*, 22(3) JOURNAL OF INTERNATIONAL ECONOMIC LAW 389.

Mitchell, Andrew D. & Neha Mishra (2021), *WTO Law and Cross-Border Data Flows: An Unfinished Agenda*, *in* BIG DATA AND GLOBAL TRADE LAW 83 (Mira Burri ed.).

Murphy, Michael P. A. (2020), *Quantising Post-Critique: Entangled Ontologies and Critical International Relations*, 49(1) MILLENNIUM JOURNAL OF INTERNATIONAL STUDIES 175.

Neeraj, R. S. (2019), *Trade Rules for the Digital Economy: Charting New Waters at the WTO*, 18 WORLD TRADE REVIEW (SPECIAL ISSUE) S121.

Nguyen, Quynh & Gabriele Spilker (2019), *The Elephant in the Negotiation Room: PTAs Through the Eyes of Citizens*, *in* THE SHIFTING LANDSCAPE OF GLOBAL TRADE GOVERNANCE: WORLD TRADE FORUM 17 (Manfred Elsig et al. eds.).

臺灣大學學術期刊資料庫

Noam, Eli (2018), *Inequality and the Digital Economy*, *in* DIGITIZED LABOR: THE IMPACT OF THE INTERNET ON EMPLOYMENT 117 (Lorenzo Pupillo et al. eds.).

Pan, Chengxin (2020), *Enfolding Wholes in Parts: Quantum Holography and International Relations*, 26 EUROPEAN JOURNAL OF INTERNATIONAL RELATIONS (SPECIAL ISSUE) 14.

Peng, Shin-yi (2015), *Cybersecurity Threats and the WTO National Security Exceptions*, 18(2) JOURNAL OF INTERNATIONAL ECONOMIC LAW 449.

Peng, Shin-yi (2018), *"Private" Cybersecurity Standards? Cyberspace Governance, Multistakeholderism, and the (Ir)Relevance of the TBT Regime*, 51 CORNELL INTERNATIONAL LAW JOURNAL 445.

Peng, Shin-yi (2022), *The Uneasy Interplay Between Digital Inequality and International Economic Law*, 33(1) EUROPEAN JOURNAL OF INTERNATIONAL LAW 205.

Peng, Shin-yi et al. (2018), *Governing Science and Technology in the Era of Megaregionals*, *in* GOVERNING SCIENCE AND TECHNOLOGY UNDER THE INTERNATIONAL ECONOMIC ORDER: REDULATORY DIVERGENCE AND CONVIENCE IN THE AGE OF MEGAREGIONALS 3 (Shin-yi Peng et al. eds.).

Philbeck, Thomas & Nicholas Davis (2019), *The Fourth Industrial Revolution: Shaping a New Era*, 72(1) JOURNAL OF INTERNATIONAL AFFAIRS 17.

Prasad, Smitha K. (2020), *State Sovereignty in the Cyberspace and the Free Flow of Data*, *in* REGULATING THE CYBERSPACE: PERSPECTIVES FROM ASIA 65 (Gisela Elsner & Aishwarya Natarajan eds.).

Prazeres, Tatiana Lacerda (2020), *Trade and National Security: Rising Risks for the WTO*, 19(1) WORLD TRADE REVIEW 137.

Roberts, Anthea et al. (2019), *Toward a Geoeconomic Order in International Trade and Investment*, 22(4) JOURNAL OF INTERNATIONAL ECONOMIC LAW 655.

Selby, John (2017), *Data Localization Laws: Trade Barriers or Legitimate Responses to Cybersecurity Risks, or Both?*, 25(3) INTERNATIONAL JOURNAL OF LAW AND INFORMATION TECHNOLOGY 213.

Shaffer, Gregory (2019), *A Tragedy in the Making? The Decline of Law and the Return of Power in International Trade Relations*, 44 YALE JOURNAL OF INTERNATIONAL LAW ONLINE 37.

Shaffer, Gregory (2021), *Governing the Interface of U.S.-China Trade Relations*, 115(4) AMERICAN JOURNAL OF INTERNATIONAL LAW 622.

Shaffer, Gregory (2021), *Trade Law in a Data-Driven Economy: The Need for Modesty and Resilience*, 20(3) WORLD TRADE REVIEW 259.

Shaffer, Gregory & Joel Trachtman (2011), *Interpretation and Institutional Choice at the WTO*, 52(1) VIRGINIA JOURNAL OF INTERNATIONAL LAW 103.

臺灣大學學術期刊資料庫

Stanley, Jan & Barry Steinhardt (2014), *Bigger Monster, Weaker Chains: The Growth of an American Surveillance Society*, *in* ETHICS AND EMERGING TECHNOLOGIES 269 (Ronald L. Sandler ed.).

Streinz, Thomas (2019), *Digital Megaregulation Uncontested? TPP's Model for the Global Digital Economy*, *in* MEGAREGULATION CONTESTED: GLOBAL ECONOMIC ORDERING AFTER TPP 312 (Benedict Kingsbury et al. eds.).

Thomas, Chantal (2019), *Trade and Development in an Era of Multipolarity and Reterritorialization*, 44 YALE JOURNAL OF INTERNATIONAL LAW ONLINE 77.

Wendt, Alexander (2022), *Why IR Scholars Should Care About Quantum Theory, Part I: Burdens of Proof and Uncomfortable Facts*, 14(1) INTERNATIONAL THEORY 119.

Wendt, Alexander (2022), *Why IR Scholars Should Care About Quantum Theory, Part II: Critics in the PITs*, 14(1) INTERNATIONAL THEORY 193.

Wu, Mark (2018), *Export Policies, Technology Transfer Policies, and Investment Reviews: How States Compete in the Era of Global High-Tech Value Chains*, *in* GOVERNING SCIENCE AND TECHNOLOGY UNDER THE INTERNATIONAL ECONOMIC ORDER: REGULATORY DIVERGENCE AND CONVIENCE IN THE AGE OF MEGAREGIONALS 90 (Shin-yi Peng et al. eds.).

Zanotti, Laura (2022), *The Moral Failure of the Quest for Certainty*, *in* QUANTUM INTERNATIONAL RELATIONS: A HUMAN SCIENCE FOR WORLD POLITICS 361 (James Der Derian & Alexander Wendt eds.).

Internet Sources

Huawei Technologies Co., Ltd. v. Kingdom of Sweden (ICSID Case No. ARB/22/2), UNCTAD INVESTMENT POLICY HUB, https://investmentpolicy.unctad.org/investment-dispute-settlement/cases/1208/huawei-v-swed en.

Hufbauer, Gary Clyde & Zhiyao (Lucy) Lu (June, 2018), *The European Union's Proposed Digital Services Tax: A De Facto Tariff*, PETERSON INSTITUTE FOR INTERNATIONAL ECONOMICS, https://www.piie.com/publications/policy-briefs/european-unions-proposed-digital-services-tax-de-facto-tariff.

Manyika, James et al. (May, 2013), *Disruptive Technologies: Advances That Will Transform Life, Business, and the Global Economy* , MCKINSEY & COMPANY, https://www.mckinsey.com/~/media/mckinsey/business%20functions/mckinsey%20digital/our%20insights/disruptive%20technologies/mgi_disruptive_technologies_full_report_may2013.pdf.

Solow, Robert M. (2007), *Heavy Thinker*, THE NEW REPUBLIC (May 21, 2007), https://newrepublic.com/article/61183/heavy-thinker.

臺灣大學學術期刊資料庫

The Clean Network, U.S. DEPARTMENT OF STATE, https://2017-2021.state.gov/the-clean-network/index.html.

Other Sources

BAKER, STEWART ET AL. (2010), IN THE CROSSFIRE: CRITICAL INFRASTRUCTURE IN THE AGE OF CYBER WAR, https://www.govexec.com/pdfs/012810j1.pdf.

General Agreement on Tariffs and Trade, October 30, 1947, 64 U.N.T.S. 187.

General Agreement on Trade in Services, April 15, 1994, 1869 U.N.T.S. 183.

NEW YORK STOCK EXCHANGE GOVERNANCE SERVICES, A 2015 SURVEY: CYBERSECURITY IN THE BOARDROOM (2015), https://www.nyse.com/publicdocs/VERACODE_Survey_Report.pdf.

World Trade Organization, *Work Programme on Electronic Commerce – Submission by the United States*, WTO Doc. WT/GC/16, G/C/2, S/C/7, IP/C/16, WT/COMTD/17 (February 12, 1999).

WORLD ECONOMIC FORUM, THE GLOBAL RISKS REPORT 2020: AN UNSETTLED WORLD (2021), http://www3.weforum.org/docs/WEF_Global_Risk_Report_2020.pdf.

WORLD TRADE ORGANIZATION (2021), WORLD TRADE REPORT 2021: ECONOMIC RESILIENCE AND TRADE. https://www.wto.org/english/res_e/booksp_e/wtr21_e/00_wtr21_e.pdf.

臺灣大學學術期刊資料庫