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Ordering the Cosmos: Private Law and Celestial Property Rights

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ORDERING THE COSMOS: PRIVATE LAW AND CELESTIAL PROPERTY RIGHTS

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ABSTRACT

The Spurring Private Aerospace Competitiveness and Entrepreneurship Act of 2015 (SPACE Act)[1] aims to promote wealth creation by guaranteeing protection of U.S. citizens' property rights to celestial resources. But there are serious concerns that government protection of space property claims are incompatible with international law. This article proposes a purely private legal system for space commerce as an alternative to government-defined and enforced property rights. Economic theory shows how property rights and rules for adjudicating disputes can be self-enforcing. Economic history shows that such a system has worked well for centuries in international trade. A private legal commercial order for space is thus both feasible and desirable.

I. INTRODUCTION

THE SPACE ACT was signed into law by President Obama on November 25, 2015. Since then, several provisions of the act have been the subject of controversy in policy and scholarly circles. Of particular importance is 51 U.S.C. § 51302, which instructs the executive branch to "promote the right of U.S. citizens to engage in commercial exploration for and commer-

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[1] Spurring Private Aerospace Competitiveness and Entrepreneurship Act, Pub. L. No. 114-19, 129 Stat. 704 (2015) [hereinafter SPACE Act].

cial recovery of space resources free from harmful interference, in accordance with the international obligations of the United States and subject to authorization and continuing supervision by the Federal Government."[2] While the text appears to guarantee private property rights to celestial resources, it is unclear to what extent this guarantee is compatible with the international obligations of the United States, indicated in Article II of the Outer Space Treaty.[3]

Under international law, states are sovereign and may define and enforce property rights within their territories. In outer space, the situation is different. No state may extend its sovereignty to outer space, as enshrined in the Outer Space Treaty, which has been signed by the United States and all other spacefaring nations. Article II of this treaty reads, "Outer space, including the moon and celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."[4] This may also prevent private citizens from appealing to their governments to defend property rights to celestial resources[5] As White[6] points out, "in common law countries such as the United States, legal theory dictates that the government must have sovereignty over territory before it can confer title on its citizens. Consequently, traditional real property rights [in outer space] are inconsistent with this theory."

More recently, Tronchetti[7] echoed White's[8] concerns:

> The Space Resource Exploration and Utilization Act appears to collide with numerous provisions of the Outer Space Treaty. Par-

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[2] 51 U.S.C. § 51302 (a)(3).

[3] Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 [hereinafter Outer Space Treaty].

[4] Outer Space Treaty, *supra* note 3, art. 2.

[5] Virgiliu Pop, *Approriation in Outer Space: The Relationship Between Land Ownership and Sovereignty on the Celestial Bodies*, 16 SPACE POLICY 275, 280–81 (2000); James E. Dustan, *Towards a Unified Theory of Space Property Rights: Sometimes the Best Way to Predict the Weather is to Look Outside*, *in* SPACE: THE FREE MARKET FRONTIER 223, 223–41 (Edward L. Hudgins ed., 2002); Wayne White, *The Legal Regime for Private Activities in Outer Space*, *in* SPACE: THE FREE MARKET FRONTIER 83, 83–111 (E.L. Hudgins ed., 2002); Sarah Coffey, *Establishing a Legal Framework for Property Rights to Natural Resources in Outer Space*, 41 CASE W. RES. J. INT'L L. 119, 139–42 (2009).

[6] *See* White, *The Legal Regime*, *supra* note 5, at 84.

[7] Fabio Tronchetti, *The Space Resource Exploration and Utilization Act: A Move Forward or a Step Back?*, 34 SPACE POL'Y 6, 9 (2015).

[8] White, *The Legal Regime*, *supra* note 5, at 96–97.

> ticularly problematic is its relation with Article II of the Treaty. Under the Act the United States attributes itself the right to confer property rights over space resources to its private companies. Importantly, under international law, property rights require a superior authority, a State, entitled to attribute and enforce them. This signifies that States need to have property rights first before being allowed to attribute them to other entities. Seeing from this perspective the Act could be interpreted as an attempt by the United States to claim property rights over asteroid resources, a position which would clash with the non-appropriation clause, not lastly because, as described, there is no consensus on whether these resources can be appropriated and exploited.

Thus, there is serious question whether the U.S. government's understandable desire to create an environment conducive to flourishing space commerce—something for which a means of defining and enforcing private property rights is essential[9]—is in fact compatible with existing international law, to which the United States has consented. Recognizing the dilemma, Tronchetti[10] points to two categories of solutions for this problem. One relies on governance mechanisms at the international level and the other at the national level. Ultimately, Tronchetti[11] seems to prefer a mixture of both:

> If the objective of the United States is to support a private asteroid mining industry this viewpoint would suggest the United States to follow an international and domestic path. Internationally, the United States should take the initiative to try to achieve recognition of the permissibility under existing space law of the appropriation and utilization of celestial bodies [sic] resources for purposes other than scientific. Until such a recognition exists any national initiative addressing this issue would be challenged and criticized. Domestically, the United States should support the nascent private space mining sector. However, rather than rushing the adoption of controversial legislation dealing with extraterrestrial property rights, it should gradually develop a national regulatory framework to manage (non-governmental) activities on celestial bodies, including the identification of competent federal agencies, the establishment of technical and safety standards as well as of licensing procedures.

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[9] *See* ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS 504 (1776); LUDWIG VON MISES, HUMAN ACTION: A TREATISE ON ECONOMICS (1949); Armen A. Alchian & Harold Demsetz, *The Property Rights Paradigm*, 33 J. ECON. HIST. 16, 22–25 (1973); Douglass C. North, *Institutions*, 5 J. ECON. PERSP. 97, 97–98 (1991).

[10] Tronchetti, *supra* note 7, at 7–8.

[11] *Id.* at 9.

Pursuing international and domestic solutions through established legal channels is certainly a worthy endeavor. However, there is a third option not considered by Tronchetti, and considered little by those exploring the architecture for a future space legal system. The two options, international and domestic, are both *public law* options. There remains the possibility of commercial space governance evolving along the lines of *private law.* A private legal order for space commerce would not use existing national or international institutions of public governance (law creation, adjudication, enforcement, etc.). Instead, law would result from specific bargains made among commercial entities, including whatever dispute resolution procedures agreed to by the parties themselves.

This article contributes to the literature on legal issues associated with property rights in space[12] by exploring the implica-

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[12] *See* Stephen Gorove, *Interpreting Article II of the Outer Space Treaty*, 37 FORDHAM L. REV. 349, 349 (1968); Wayne N. White, Jr., *Real Property Rights in Outer Space*, SPACE FUTURE (1998), http://www.spacefuture.com/archive/real_ property_rights_in_outer_space.shtml [https://perma.cc/3CCY-75CC]; Wayne N. White, Jr., *Interpreting Article II of the Outer Space Treaty*, PROC. FORTY-SECOND COLLOQUIUM ON L. OUTER SPACE 174, 179–80 (2003); Ricky J. Lee, *Reconciling International Space Law with the Commercial Realities of the Twenty-First Century*, 4 SING. J. INT'L & COMP. L. 194, 237 (2000); Lawrence A. Cooper, *Encouraging Space Exploration Through a New Application of Space Property Rights*, 19 SPACE POLICY 111, 117 (2003); Michael J. Listner, *The Ownership and Exploitation of Outer Space: A Look at Foundational Law and Future Legal Challenges to Current Claims*, 1 REGENT J. INT'L L. 75, 94 (2003); Carol R. Buxton, *Property in Outer Space: The Common Heritage of Mankind Principle vs. the "First in Time, First in Right" Rule of Property*, 69 J. AIR L. & COM. 689, 705–07 (2004); Brandon C. Gruner, Comment, *A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonozation of Outer Space in the Twenty-First Century*, 35 SETON HALL L. REV. 299, 355–57 (2004); Henry R. Hertzfeld & Frans G. von der Dunk, *Bringing Space Law into the Commercial World: Property Rights Without Sovereignty*, 6 CHI. J. INT'L L. 81, 98–99 (2005); Rosanna Sattler, *Transporting a Legal System for Property Rights: From the Earth to the Stars*, 6 CHI. J. INT'L L. 23, 44 (2005); Jeremy L. Zell, Note, *Putting a Mine on the Moon: Creating an International Authority to Regulate Mining Rights in Outer Space*, 15 MINN. J. INT'L L. 489, 518 (2006); Nikhil D. Cooper, Note, *Circumventing Non-Appropriation: Law and Development of United States Space Commerce*, 36 HASTINGS CONST. L. Q. 457, 482 (2009); Alan Wasser & Douglas Jobes, *Space Settlements, Property Rights, and International Law: Could a Lunar Settlement Claim the Lunar Real Estate It Needs to Survive?*, 73 J. AIR L. & COM. 37, 78 (2008); Tony Milligan, *Property Rights and the Duty to Extend Human Life*, 27 SPACE POL'Y 190, 193 (2011); Rand Simberg, *Homesteading the Final Frontier: A Practical Proposal for Securing Property Rights in Space*, COMPETITIVE ENTERPRISE INST. 1 (2012), http://cei.org/sites/default/files/Rand%20Simberg%20-%20 Homesteading%20the%20Final%20Frontier.pdf; Rand Simberg, *Property Rights in Space*, THE NEW ATLANTIS (2012); Brian C. Weeden & Tiffany Chow, *Taking a Common-Pool Resources Approach to Space Sustainability: A Framework and Potential Pol-*

tions of a private legal order for celestial commerce. Similar to Salter and Leeson,[13] this article explores the feasibility of a widespread private legal order for commercial space activities, as well as the socially beneficial aspects of this kind of ordering. This argues that a private legal order permits the sophistication and adaptability required to meet the inevitable wide range of particular circumstances facing commercial entities, while also providing the assurance necessary for commercial entities to form expectations of each other's future behavior. Since the article discusses legal order not enforced by the state, it is also a part of the literature on "analytic anarchism,"[14] or how individuals and social groups are able to govern themselves when they do not have an irresistible monopoly enforcer. Systems of private law lack this enforcer and so must devise order by other means.

The remainder of this article is organized as follows: Section II explores the feasibility of a private commercial legal order in space. Section III considers the socially desirable aspects of such a legal order. Section IV concludes by addressing several possible objections.

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icies, 28 SPACE POL'Y 166, 172 (2012); Matthew Feinman, *Mining the Final Frontier: Keeping Earth's Asteroid Mining Ventures from Becoming the Next Gold Rush*, 14 PITT. J. TECH. L. & POL'Y 202, 234–35 (2014); Lauren E. Shaw, *Asteroids, the New Western Frontier: Applying Principles of the General Mining Law of 1872 to Incentive Asteroid Mining*, 78 J. AIR L. & COM. 121, 168–69 (2013); Thomas R. Irwin, Note, *Space Rocks: A Proposal to Govern the Development of Outer Space and Its Resources*, 76 OHIO ST. L.J. 217, 245–46 (2015); Andrew Lintner, *Extraterrestrial Extraction: The International Implications of the Space Resource Exploration and Utilization Act of 2015*, 40 FLETCHER F. WORLD AFF. 139, 153–54 (2016); Alexander William Salter, *Space Debris: A Law and Economics Analaysis of the Orbital Commons*, 19 STAN. TECH. L. REV. 221, 237–38 (2016).

[13] *See* Alexander W. Salter & Peter T. Leeson, *Celestial Anarchy: A Threat to Outer Space Commerce?*, 34 CATO J. 581, 592–93 (2014).

[14] *See, e.g.*, DAVID FRIEDMAN, THE MACHINERY OF FREEDOM: GUIDE TO A RADICAL CAPITALISM xii–xv (3d ed. 2014); ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES 1–11 (1991); TERRY L. ANDERSON & PETER J. HILL, THE NOT SO WILD, WILD WEST: PROPERTY RIGHTS ON THE FRONTIER 4–5 (2004); Bryan Caplan & Edward P. Stringham, *Privatizing the Adjudication of Disputes*, 9 THEORETICAL INQUIRIES L. 504, 599 (2008); Benjamin W. Powell & Edward P. Stringham, *Public Choice and the Economic Analysis of Anarchy: A Survey*, 140 PUB. CHOICE 3–4 (2009); Peter Boettke, *Anarchism and Austrian Economics*, 7 NEW PERSEPCTIVES ON POLITICAL ECONOMY 1 (2011); Edward P. Stringham & Todd J. Zywicki, *Hayekian Anarchism*, 78 J. ECON. BEHAV. & ORG. 290, 293 (2011); PETER T. LEESON, ANARCHY UNBOUND: WHY SELF-GOVERNANCE WORKS BETTER THAN YOU THINK 1-3, 10 (2014); EDWARD P. STRINGHAM, PRIVATE GOVERNANCE: CREATING ORDER IN ECONOMIC AND SOCIAL LIFE (2015).

II. SELF-ENFORCING EXCHANGE: THE FEASIBILITY OF PRIVATE LAW[15]

A. Theory

Many economists and legal theorists believe that widespread social order, including protection of private property, requires a strong state to enforce contracts and uphold the rule of law. While social scientists concede that in some small-scale settings private ordering is viable, a large and robust commercial network requires some element of public ordering. Today, this role is filled by the state, which can reasonably be modeled as an irresistible monopoly enforcer. This explains why many writers on space commerce assume there must be some form of public ordering—either national or international—that creates and enforces property rights to celestial resources. The conventional wisdom is admirably summarized by Pop: "Appropriation of land can exist outside the sphere of sovereignty, but its survival is dependent upon endorsement from a sovereign entity."[16]

The standard model employed by social scientists when considering how individuals act without recourse to a sovereign enforcer is the Prisoners' Dilemma. Two individuals, Alice and Bob, are considering whether to acknowledge each other's private property rights. Each has two choices: respect the property claims of the other (cooperate) or prey on the other and take the other's property (defect). Assume that Alice and Bob make their choices simultaneously. If they both choose to cooperate, they each receive a payoff of $A > 0$, gained from the enjoyment of their property. However, if Alice defects while Bob cooperates, Alice can receive a higher payoff $C > A$, while Bob is left with $B < 0$. If both choose to defect, they engage in mutually costly conflict and are left with a payoff of 0 each. This situation is represented in the game matrix labeled Figure 1 below.

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[15] This section is adapted from Salter & Leeson, *supra* note 13, and is a condensation of the argument contained therein.

[16] Pop, *supra* note 5, at 281.

Figure 1—The Prisoners' Dilemma[17]

	Cooperate	Defect
Cooperate	A, A	B, C
Defect	C, B	0, 0

Without a sovereign to uphold Alice's and Bob's property claims, they will both choose to defect. While they could both earn a higher payoff if they cooperated, each player maximizes his or her payoff by choosing to defect, regardless of what the other player does. In other words, defecting is a dominant strategy. We appear to be stuck in the Hobbesian jungle.

However, the above is limited in one important respect: it assumes a one-time interaction between Alice and Bob. This is not very realistic. When describing the behavior of potential economic partners, it makes much more sense to assume they will interact multiple times over their lives. If we assume Alice and Bob will face this choice not just once, but indefinitely into the future as well, the situation looks quite different. Suppose that Alice and Bob are each willing to give the other a chance to cooperate, but if either encounters defection, they will refuse to cooperate (defect) for all subsequent interactions. Further assume that each player discounts future payoffs by a factor of β, which is between 0 and 1, since future payoffs are worth less than that same payoff today, all else being equal. The closer β is to 1, the less a player discounts future payoffs, implying a greater degree of 'patience.' Now, the payoff for cooperation is

Figure 2

$$\sum_{t=0}^{\infty} \beta^t A$$

The payoff to each player for defecting is still C. But if they choose to do this, they will receive a payoff of 0 in all future

[17] Salter & Leeson, *supra* note 13, at 585.

periods. Using the rule for solving an infinite geometric series and then solving for β, cooperation becomes the preferred strategy for both Alice and Bob so long as

Figure 3

$$\beta > \frac{C - A}{C}$$

In other words, so long as Alice and Bob are sufficiently patient—they do not discount future payoffs too steeply—then a cooperative solution is possible, even without a sovereign enforcer. Mutual respect of property rights becomes self-enforcing. Social scientists call this the *discipline of continuous dealings*: since the gains from defection are gained only once, but the gains from cooperating extend into the indefinite future, rational individuals will be much more likely to cooperate when they repeatedly interact.[18] When applied to property rights in the context of space commerce, we have good reason to suspect that the relevant parties will be patient. Engaging in space commerce requires large up-front investments before commercial entities will begin to see positive cash flow. Because of these large fixed costs, space commerce as an industry will select for those who are relatively patient, and are thus much more likely to engage in cooperative ventures, including respecting the property claims of other commercial entities.

The discipline of continuous dealings shows that, even without an irresistible monopoly enforcer, property rights can exist and be sustained. This is the foundation of a private commercial legal order, but it is not a private commercial legal order itself. More than theory is needed to demonstrate that purely private law is viable. Fortunately, history supplies us with several such examples, in such varied situations as medieval Iceland[19] and the 19th century American frontier.[20] Probably most relevant to the problem of private legal ordering for space commerce is in-

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[18] The above example had only two parties, Alice and Bob, but the logic holds if there are more than two parties. In fact, as we add additional players, the possibility of reputational effects strengthens the tendency for cooperation. If Alice wishes to defect in her dealings with Bob, she not only has to worry about losing future payoffs from cooperating with Bob, but she runs the risk of Bob telling Charlie about Alice's antisocial behavior. Thus, Alice loses two future trading partners instead of just one.

[19] *See* FRIEDMAN, *supra* note 14, at xii–xv.

[20] *See* ANDERSON & HILL, *supra* note 14, at 9.

ternational trade and the institutions that provide the legal framework that governs it.

B. History

Internationally, there is no sovereign. The world's polities exist in a "state of nature." Thus, there is no formal organization that can define and enforce property rights among individuals from different states who engage in commerce. "In this sense the property rights situation that parties to international commerce confront is similar to the property rights situation that prospective parties to outer space commerce confront."[21] If conventional wisdom regarding the infeasibility of widespread secure private property rights is accurate, then international anarchy should render commerce between subjects of different states extremely difficult and highly uncertain. Instead, we observe international commercial activity as rich, varied, and lucrative. Parties to international commercial deals have access to a sophisticated private and voluntary legal system that helps them adjudicate disputes and accurately form expectations of future behavior such that the need for dispute resolution in the first place is low. It would be inaccurate to describe international commerce as an Eden of laissez-faire, but it is far more orderly than the conventional wisdom would suggest.

The reasons for this are complex and have deep historical roots. It is well known that, following the collapse of the Roman Empire in the West, the volume of international trade shrank considerably.[22] The legal infrastructure provided by the Empire no longer stood, and the transition away from this order caused significant commercial disruption. By the ninth and tenth centuries, trade was recovering.[23] Across Europe, a professional merchant class emerged and developed mechanisms to resolve disputes over property rights and contract enforcement, even when subjects were from different polities and thus no national court had jurisdiction.[24]

The solution was private, merchant-developed law that was enforced in private, merchant-developed courts. This medieval law merchant (*lex mercatoria*) was a system of self-enforcing property

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[21] Salter & Leeson, *supra* note 13, at 588.

[22] *See* Bruce L. Benson, *The Spontaneous Evolution of Commercial Law*, 3 Southern Econ. J. 645, 646 (1989).

[23] *See id.*

[24] *See id.* at 646–47.

rights according to legal rules that emerged out of dispute resolution among interested parties.[25] On this basis, international commerce and commercial law "have developed coterminously, without the aid . . . of the coercive power of nation-states . . . ."[26] The content of these rules initially owed much to the newly-rediscovered Roman civil law. But the rules evolved as best commercial practices in specific geographic locales became recognized and incorporated into the *lex mercatoris*, such that they informed and became a part of standard merchant practice for those engaged in international trade.[27]

As for the courts, they developed their own rules of evidence and protocols for consulting experts, whose services were frequently needed when dealing with the highly specialized issues that pertained to international commercial contracts. Benson[28] and Milgrom et al.[29] note that these courts often operated with significantly less pomp and circumstance than the national courts of the time and reached decisions much more quickly, which was a feature highly valued by international traders. As for enforcing a merchant court's decision, international traders relied on reputational effects in the context of the discipline of continuous dealings, as described earlier.[30] The courts themselves had no formal enforcement power. They could not coercively compel compliance with a decision.[31] But most traders complied with merchant court decisions, even without the threat of coercive enforcement. Failure to do so would quickly brand one as a defector, and thus unsafe as a trading partner.[32] This would make it extraordinarily difficult to find willing trading partners, and hence to continue to make profits, in the future. Thus, the vast majority of decisions regarding contract dispute were self-enforcing.

Today, international trade is still overwhelmingly privately governed. Although modern states have much higher capacity to create and enforce property rights than medieval polities, those engaged in international trade choose to make use of pri-

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[25] *Id.* at 647.

[26] *Id.* at 645.

[27] *Id.* at 648.

[28] *Id.* at 649–51.

[29] *See* Paul R. Milgrom et al., *The Role of Institutions in the Revival of Trade: The Law Merchant, Private Judges, and the Champagne Fairs*, 2 ECONOMICS & POLITICS 1, 5–6 (1990).

[30] *See id.* at 7–14.

[31] *See* Benson, *supra* note 22, at 650.

[32] *See* Milgrom et al., *supra* note 29, at 9–10.

vate arbitration.[33] At least ninety percent of international commerce contracts contain clauses that state parties will, in the event of dispute, pursue private arbitration.[34] In 2001, the largest provider of private arbitration services, the International Chamber of Commerce (ICC), was involved in disputes between over 1,500 parties from 115 countries. These disputes ranged from $50 to $1 billion, with over sixty percent for amounts between $1 million and $1 billion.[35] In the same year, the International Center for Dispute Resolution, another private arbitration organization, was involved in disputes totaling $10 billion with parties from sixty-three countries.[36] As in medieval times, decisions reached by private arbitration are almost always respected by the commercial parties. The ICC estimates that ninety percent of its decisions are complied with voluntarily,[37] due to the discipline of continuous dealings and reputational effects.[38]

Theory and history thus show that creation and enforcement of private property rights, along with a body of law that provides for dispute adjudication, can exist even without sovereign oversight. There is no prima facie reason to think that "celestial anarchy," an environment free from the jurisdiction of national sovereigns due to Article II of the Outer Space Treaty, will be any different than international anarchy on earth. But this merely demonstrates that widespread private ordering for space commerce is *viable*. It remains to be seen whether such a system is *desirable*. The next section considers this latter criterion.

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[33] Peter T. Leeson, *How Important is State Enforcement for Trade?*, 10 AM. L. & ECON. REV. 61, 62 (2008).

[34] *Id.* at 64.

[35] Salter & Leeson, *supra* note 13, at 590 (citing *2001 Statistical Report*, 13(1) ICC INT'L CT. ARB. BULL. 5, 6, 8 (2002)).

[36] *See* Salter & Leeson, *supra* 13, at 593.

[37] Leeson, *How Important is State Enforcement*, *supra* note 33, at 68.

[38] Since 1958, sovereigns have had a partial role in enforcing international trade contracts. In that year, the first multinational treaty was signed to facilitate the enforcement of private arbitration decisions in national courts. Signatory nations to the United Nations New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards (the New York Convention, or NYC) agree that, if a citizen loses an arbitration judgment to a foreign national, the foreign national can have this decision coercively enforced by the citizen's government. However, this does not invalidate the self-enforcing nature of international commerce for two reasons. First, international commerce was substantial prior to 1958. Even if the treaty helped, it was by no means necessary. Second, the treaty is still an agreement among sovereigns who are in a state of nature with respect to each other. International anarchy still prevails, since there is no international sovereign who can compel agreement and compliance. *See* Leeson, *How Important is State Enforcement*, *supra* note 33, at 83.

III. ORGANIZATIONS AND ORDERS: THE DESIRABILITY OF PRIVATE LAW

A. KINDS OF SOCIAL ORDER

Desirability is an inherently normative concept, dealing in statements not just of "is," but also of "ought." To keep the analysis as broad as possible, when the author argues that a private legal order for celestial commerce is desirable, he means that it possesses general features conducive to the satisfaction of human wants that are near-unanimously judged to be socially beneficial. These features are the combination of stability and adaptability: a legal system ought to provide firm ground upon which parties can form reliable expectations of future behavior but must also be sensitive to particulars and changeable when circumstances require.

As a body of rules for coordinating social behavior, a legal system must possess mechanisms that align the *incentives* of those who act within it and provide them the *information* necessary to achieve their goals in a way compatible with the similar desire of others. To understand how this is possible, we need to distinguish between two kinds of order, regularity or coordination, in the social world.[39] The most salient kind of order is consciously brought into being.[40] This kind of order is purposively created by a mind or group of minds.[41] An example would be a business firm or an administrative bureaucracy. These types of social bodies, or *organizations*, can be reasonably characterized as having a goal or teleology.[42] However, purposely created order is not the only kind of order in the social world. There is also emergent or spontaneous order; to paraphrase Adam Ferguson, "the result of human action, but not the execution of any human design."[43] These orders are not intentionally created by any one mind or group of minds.[44] As social systems, they frequently have tendencies or characteristics, but they are not goal-oriented.[45] Hayek calls this kind of system an "order," or (felicitously, given this

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[39] *See* 1 F. A. HAYEK, LAW, LEGISLATION AND LIBERTY: RULES AND ORDER 35–54 (1973).

[40] *See id.* at 36.

[41] *Id.*

[42] *See id.* at 37.

[43] Adam Ferguson, *An Essay on the History of Civil Society* 1, 205 (1767), http://oll.libertyfund.org/titles/ferguson-an-essay-on-the-history-of-civil-society [https://perma.cc/5PFK-M6WS].

[44] *See* HAYEK, LEGISLATION AND LIBERTY, *supra* note 39, at 36–37.

[45] *Id.* at 38.

article's subject) a *cosmos*.[46] An order is created by interactions among various organizations.[47] The properties of the order can be explained with reference to the characteristics of the organizations that interact within it, but these properties are not reducible to the various constituent organizations.[48] The whole is more than the sum of its parts; or, more accurately, the whole has properties that are exhibited by none of the parts in particular.[49]

The organization-order distinction has been most extensively developed in the theory of markets. Markets are comprised of organizations (households, firms) but the market itself is an order. Hayek[50] explored the properties of markets as orders, noting that in markets, millions of individuals are somehow able to coordinate their actions and cooperate with each other, in their capacities as consumers or producers, despite not knowing each other personally, and despite knowing only an infinitesimal amount of the total knowledge embedded within markets. Markets are able to achieve a tremendous degree of coordination due to the system of prices that continually adjust in response to changing supply and demand conditions.[51] Market prices express tradeoffs, in the form of real resource scarcities across various alternative lines of production. When acting in markets, households' and firms' subjective valuations of goods and services confront objective tradeoffs.[52] When supply and demand conditions change, prices change, which provide a crutch for households and firms in coordinating their production and consumption decisions.

As an example, if an unexpected frost kills a portion of an orange crop, fewer oranges will be available for exchange on the market. In the interests of efficiency (directing resources to their highest-valued uses), the marginal orange should be saved for only the most valuable, *feasible* lines of production or consumption, which have been reduced due to the frost. Markets provide the information and incentives necessary for precisely this to happen: the reduced supply of oranges will cause the price of oranges to rise; households that consume oranges, and

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[46] *Id.*
[47] *Id.* at 37.
[48] *Id.* at 36.
[49] *Id.* at 42.
[50] *See* F. A. Hayek, Individualism and Economic Order 33–56 (1948).
[51] *See id.* at 41–42.
[52] *See id.* at 44–45.

firms that purchase oranges to make orange juice, etc. will scale back their purchase of oranges. This leaves more of the smaller total quantity of oranges for purchase by those who are willing to pay the higher price. But, those who are willing to pay the higher price are those who value the oranges more highly in consumption, or are those who believe they can use the oranges as inputs into producing other goods, such as Grand Marnier, which are more valuable to consumers, and thus justify paying the higher price. No household or firm needs to know specifics about the frost nor exactly how the price effects of the frost will spill over into various markets. Markets help generate this knowledge due to the mutual adjustments between suppliers and demanders and provide each an incentive to steward the scarce resource in the form of a cost (the price) that must be incurred in order to acquire the resource.[53]

Thus, the *tendency* towards efficiency, and thus the mutual coordination of consumers' and producers' plans, is a property not of any household or firm, or group of households or firms, but the market itself.[54] This also suggests why command and control solutions to economic problems, such as complete socialism, fail. Command and control for an entire market economy destroys the social intelligence of the marketplace by replacing it with the much, much more limited intelligence of the organization in charge of allocating resources. The knowledge necessary to put resources to their highest-valued uses does not exist in a manner that can be harnessed by any person or group. The market, in order to deliver the benefits we have come to expect from commercial exchange, must be an order.

The above summary of the core insight of market theory illustrates the importance of orders in promoting social coordination. Many things are far too complex to be trusted to consciously crafted organizations. Within the field of law and economics, many scholars have noted that legal systems, as sources of social rule creation and enforcement, also fit the organization-order typology. An example of organization-created rules would be bureaucratic fiat, whereas an example of order-created rules would be judicial decisions in a common law system. Posner[55] famously argued that the common law system had

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[53] *See id.* at 50–55.

[54] *Id.*

[55] *See* RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 249–75 (Vicki Been et al. eds., 7th ed. 2007).

strong tendencies to produce efficient legal rules and linked this tendency to features of the system such as judge-made law, adversarial proceedings, and precedent. For our purposes, what matters is the emphasis Posner and other scholars placed on the adjustment mechanisms in legal systems that helped coordinate the behavior of those who acted within these systems.

B. Order and Private Law

In a competitive, discovery-oriented legal system, rules are analogous to market prices.[56] Market prices give parties information regarding the terms of exchange; legal rules give to parties the terms of interaction, providing a "language" of interpersonal conduct.[57] Like market prices, legal rules that coordinate the actions of those governed by these rules must be discovered, rather than set in advance.[58] A private legal ordering of the kind discussed in Section II is one in which rules that do a good job of providing both stability and flexibility are likely to be discovered and maintained, while rules that do a poor job are likely to be discarded. The medieval and modern law merchant are legal orders that are private. Its rules emerge from the decentralized interaction of traders and arbitrators, rather than from any centralized apparatus of command.[59] Admittedly, it is not the only kind of legal order possible. The common law is also an order, as the writings of Hayek and Posner show.[60] Furthermore, the role of public courts in common law systems show that a legal order need not be wholly private. But, such a legal order *can* be purely private, as the law merchant demonstrates.

What are the systemic properties of private commercial law that produce social coordination, by aligning the incentives and information of those engaged in commerce? There are several institutional features that, in tandem, achieve this.[61] First, the

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[56] *See* Todd J. Zywicki & Anthony B. Sanders, *Posner, Hayek, and the Economic Analysis of Law*, 93 Iowa L. Rev. 559, 590 (2008).

[57] *See id.* at 591.

[58] *See id.* at 594–96.

[59] *Id.* at 597.

[60] *See id.* at 602–03.

[61] *See* Benson, *supra* note 22, 660–61; Bryan Caplan & Edward P. Stringham, *Privatizing the Adjudication of Disputes*, 9 Theoretical Inquiries L. 503, 528 (2008); Friedman, *supra* note 14, at xii–xv; David Friedman, *Private Creation and Enforcement of Law: A Historical Case*, 8 J. Legal Stud. 399, 410–11 (1979); Carrie B. Kerekes & Claudia R. Williamson, *Discovering Law: Hayekian Competition in Medieval Iceland*, 21 Griffith L. Rev. 432, 445 (2012); Edward Stringham, *Market Chosen Law*, 14 J. Libertarian Stud. 53, 76–77 (1999); Edward P. Stringham,

foundational principles of private commercial law, which will likely be applicable to nascent space commerce as well, are well established through centuries-long usage. Importantly, this does not preclude innovations at the margin, as particular circumstances arise that extend the application of the basic legal principles to new particulars, without erasing the principles themselves:

> [T]he primary principles underlying customary business law are [unlikely] to change. The basic rules of private property and freedom of contract developed centuries ago . . . the need for extensions of these basic principles to cover unanticipated circumstances always arises, however, and customary law adapts, building on the existing base of substantive principles.[62]

These foundational principles are the basic material commercial traders use to form expectations about what rules will be respected in engaging with fellow trading partners, what actions cause parties to seek adjudication, and how those adjudications are likely to be resolved. Importantly, the customary body of merchant law is not codified law, in the sense of a centrally compiled set of rules that detail how particular disputes have been or will be resolved.[63] Rather, the law took the form of

> written commercial instruments and contracts. *In this regard, note that 'contract law' refers to the 'law' that parties in exchange bring into existence by their contractual agreement rather than to the law of or about contracts.* . . . As contractual form came into common usage it actually became a part of the Law Merchant.[64]

While the foundational principles are unchanging, their particular applications frequently do change to meet the needs of commerce. The principles provide stability, but contractual innovations that arise as the needs of trade dictate, and are enforced in private commercial courts, provide flexibility.[65] Furthermore, these contractual innovations, provided they persistently help traders meet their goals, become generally used in the course of commerce, and thus become law.[66] As Benson notes:

Extending the Analysis of Spontaneous Market Order to Governance, 42 ATLANTIC ECON. J. 171, 178 (2014); STRINGHAM, *supra* note 14, at 4–5.

[62] Benson, *supra* note 22, at 659 (footnotes omitted).

[63] *See id.* at 649.

[64] *Id.* at 649 (emphasis added) (footnotes omitted).

[65] *See id.* at 649–51.

[66] *See id.* at 651–54.

> [i]f a contract is a standard one based on long standing tradition, it simply reflects existing customary commercial law; if a contract develops an effective new business practice in the face of a new situation, it is likely to add to customary law. Since commerce operates in a dynamic continually changing environment, new contractual arrangements are always being mediated—*new law is being created.*[67]

This combination of stability and flexibility is what provides traders and arbitrators the information they need to coordinate their behavior. The foundational customary principles, which are widely publicly known, give adjudicators information on how to deal with basic disputes; traders know this, and take actions to avoid basic disputes, since disputes are costly to all parties.[68] Particular extensions can be less well known, since in modern commercial arbitration the proceedings and awards of damages are almost always kept private. However, traders and arbitrators interact within a social network that fosters the transmission of information. For example, arbitrators may discuss cases by anonymizing key details. And while there are no case books for international commercial arbitration, papers and books prepared by arbitrators for conferences and other professional gatherings provide a way for both traders and arbitrators to get some insight for how similar conflicts in the future may be resolved. Furthermore, while the details of the outcome of an arbitration may be unobserved, the fact that a contract ends up being arbitrated in the first place is observable. That a particular contractual form resulted in a dispute is itself useful information for traders and arbitrators to take into account.

Second, traders and arbitrators have strong incentives to act in a manner that resolves disputes in as low-cost a manner as possible. As mentioned above, traders very frequently write arbitration clauses into their contracts.[69] If a conflict over contractual interpretation arises, traders want to resolve this conflict as quickly and cheaply as possible; the more time and money tied up in adjudication, the less time available for actually engaging in profitable commerce.[70] Adjudicators are also cost-conscious: they must be voluntarily selected by all parties, since compulsory jurisdiction does not exist. The selection of an adjudicator would depend on traders' perception of an adjudicator's exper-

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[67] *Id.* at 658 (emphasis added).

[68] *Id.* at 650.

[69] *See* Leeson, *supra* note 33, at 64.

[70] *See* Benson, *supra* note 22, 656–57.

tise, as well as their reputation for impartiality (while selfish traders may prefer an adjudicator biased in their favor, this is highly unlikely to be agreed to by the other parties, since selection of an adjudicator must be voluntary and unanimous).[71] Adjudicators who were perceived to be biased or inexpert would find their reputations suffer, losing business as a result.[72] And as already mentioned, traders are very likely to agree voluntarily to an adjudication decision, even if they believe it was decided in error in their particular case. Traders who reneged would acquire a reputation of being untrustworthy and would find it difficult to secure trading partners in the future.[73] Except perhaps in disputes involving extraordinarily large sums of money, with one of the traders not anticipating being "in the game" for much longer, defection from previously agreed upon arbitration procedures is unlikely.

C. Social Benefits

The information-generating and incentive-aligning features of a private legal commercial order are obviously beneficial for traders and arbitrators, but they are also beneficial for the rest of society as well. This is because economizing on costs—using as few resources to achieve a goal as possible—leaves more resources left over that can be put to other uses. When a firm cuts costs, it makes higher profits, which benefits the firm. But in lowering costs, it has also used up less resources, which can now be used to satisfy other wants. This is good even for those who do not work for the firm or do business with the firm. For example, even those who do not ride trains prefer to live in a world where railroad businesses use steel rails, rather than platinum or titanium. These latter metals have much higher valued uses, such as in communications satellites. In a world where railroads are built using platinum or titanium, all society gets is expensive rail travel. But in a world where railroads are built using steel, and platinum and titanium are saved for making communications satellites, society gets cheap rails as well as telecommunication services. Society is wealthier by the amount of resources saved by economizing on costs.

The information generated by a private commercial order helps traders avoid conflict. Conflict is costly for traders; adjudi-

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[71] *See id.* at 649.

[72] *See id.*

[73] *See* Milgrom et al., *supra* note 28, at 9–10.

cating conflict uses up real resources.[74] Avoiding conflict in the first place makes both traders and society as a whole wealthier. But some amount of conflict due to honest disagreement over contractual terms is unavoidable. In this situation, the incentives of traders and arbitrators is to settle the dispute as quickly as possible, subject to some decision procedure which is voluntarily agreed upon, and thus decided by all parties to be beneficial *ex ante*.[75] Specific practices of merchant courts, such as simple rules of evidence and forbidding appeals, result in minimal resources devoted to conflict resolution, which again reflects the interests of both traders and arbitrators, as well as society at large in the form of economized costs.[76]

The incentives of traders and arbitrators are aligned through reputational effects and the discipline of continuous dealings. Traders bear the costs of arbitration and will only engage in arbitration when they find such procedures to be mutually beneficial. Arbitrators will preside over cases in exchange for compensation, the future prospects of which incentivize them to reach speedy and unbiased decisions. Because the costs of dispute resolution are borne primarily by the parties to these disputes, a private commercial legal order gives parties the incentive to act in socially beneficial ways—or, to put it differently, the incentives within the system align what is personally beneficial with what is socially beneficial.

Finally, it is worth contrasting this private legal commercial order with the likely characteristics of a legal order that would arise out of national or international governing bodies attempting to impose a set of rules.[77] This would transform the legal system from an order into an organization. Whereas a competitive private legal order is capable of generating and conveying to actors a greater amount of knowledge than any one of them can acquire on their own, an organization cannot benefit from this social intelligence mechanism.[78] Rather than taking advantage of the competitive discovery procedures embedded in a private

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[74] *See* HAYEK, LEGISLATION AND LIBERTY, *supra* note 39, at 41–45, 50–55.

[75] *See* Benson, *supra* note 22, at 649.

[76] *Id.* at 650.

[77] Neither a national nor an international governing body, in the abstract, must be a bureaucratic or regulatory organization. But given the constraints posed by the Outer Space Treaty, the most likely course of *public* action in the pursuit of celestial governance would be this kind of organization or organizations. Of course, there is nothing precluding sovereigns from amending international law to avoid this situation. *See infra* Part IV.

[78] LUDWIG VON MISES, BUREAUCRACY 48–56 (1944).

legal commercial order, the overseeing organization would, by necessity, be taking a top-down approach.[79] Bureaucrats and regulators in this scenario would not be able to do as well in implementing socially beneficial rules because there is no feedback mechanism informing them which rules best serve the interests of commercial parties.[80] Furthermore, bureaucrats and regulators would face much weaker incentives to find effective rules.[81] Since they are making decisions the costs and benefits of which primarily are borne by others, bureaucrats and regulators would not personally confront costs and benefits in the same way as under a private legal commercial order.[82] In fact, the economic literature on bureaucracy strongly suggests that bureaucrats engage in cost-*maximizing* behavior, rather than cost-minimizing behavior,[83] because of a lack of competitive pressure and personal cost bearing. Because of these incentive and information problems, a private legal order for space commerce is more consistent with desirable social consequences, such as cost-minimization, than typical public organizational solutions.

IV. CONCLUSION

The SPACE Act attempts to create an environment conducive to space commerce by promoting U.S. citizens' property rights to celestial resources. This is controversial because it seems to run afoul of Article II of the Outer Space Treaty.[84] The problems posed by Article II can be overcome by a private law regime for space commerce. A private law regime for space commerce is feasible: property claims to celestial resources, along with rules for adjudicating conflicts over these claims, can be self-enforcing. Thus, property rights and rules do not require protection or enforcement by sovereign states. A private law regime for space commerce is also desirable: as a spontaneous order, it is stable enough to ground commercial actors' expectations and flexible enough to meet the particulars of new contractual arrangements. The legal regime renders the pursuit of self-interest by commercial parties both information- and incentive-compatible with social wellbeing.

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[79] *See id.* at 48–53.

[80] *Id.* at 40–56

[81] *See id.* at 51–52.

[82] *See id.* at 53–55.

[83] *See* GORDON TULLOCK, BUREAUCRACY (1965), *reprinted in* 6 THE SELECTED WORKS OF GORDON TULLOCK 210–23 (Charles K. Rowley ed., 2005).

[84] *See* Tronchetti, *supra* note 7, at 8.

There are several anticipated objections to this article. First, as Tronchetti argues, both national and international law can be modified to create a foundation for space commerce.[85] This is true; national and international efforts certainly should be made to clarify certain points of international space law. However, since significant amendment to the legal regime will have to take place internationally in order to make clear the relationship between territorial sovereignty and sovereign property rights enforcement—or, in the extreme case, repealing Article II—it must result from consensual agreement among sovereign states. Securing this consent will likely be incredibly costly. Given the feasibility and desirability of private commercial law in space, a strong argument will have to be made for the superiority of some form of public law in this case for the benefits of international treaty amendment to be worth the costs.

Second, critics may charge that this approach is a de facto concession of all authority by national space regulatory bodies. This is not true. Instead, embracing a private commercial legal order for space requires *reorientation* of these agencies. Existing agencies can perform other roles that do not violate Article II. For example, federal agencies can oversee launches by private companies in the United States, to ensure safety standards are met and that commercial space entities do not inadvertently damage citizens' lives or livelihoods. Agencies can also mitigate the problem of space debris in desirable orbits, especially the low earth orbits, by enforcing rules for deorbiting useless material. In fact, many agencies are currently performing these or similar roles, and there is nothing in my argument that compels them to stop.[86] The feasibility and desirability of private legal commercial order in space still leaves ample room for national agencies to keep space both safe and accessible for citizens, without amounting to a de facto extension of territorial sovereignty, as Tronchetti[87] shows.

Third, critics might embrace a narrower definition of desirability than currently discussed, one that a private legal commercial order for space may not meet. While this objection is obviously too broad to respond to *sui generis*, the one that merits attention concerns wealth distribution. It may be conceded that

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[85] *Id.* at 7–8.

[86] *See, e.g.*, Brian Dunbar, NASA Invests in Private Sector Space Flight with SpaceX, Rocketplane-Kistler (2006), https://www.nasa.gov/exploration/news/COTS_selection.html [https://perma.cc/VJ53-T9BA].

[87] *See* Tronchetti, *supra* note 7, at 9.

a private legal commercial order for space is desirable in that it would create massive amounts of new wealth. But the distribution of this wealth might be sufficiently objectionable that it outweighs the creation of the wealth itself. This claim is incredible, but a satisfactory reply is to allow the private commercial order in space, thereby allowing massive new wealth creation, and then using domestic policy to affect a more desired distribution. If a U.S. company creates wealth in space, the U.S. government might not be able to enforce that company's rights without violating Article II, but there is no reason why it cannot tax the company's earnings.[88] These tax dollars can then be allocated publicly in line with distributional goals. Ultimately, wealth must be created before it can be distributed. Compared to the extreme scenario of not allowing new wealth creation in the first place, allowing the wealth creation and then redistributing some of it makes many people better off, and nobody worse off.

We cannot know in advance how the existing body of private commercial law will apply to space commerce. While we know that some self-enforcing property and legal regime will emerge out of contracting among commercial space entities, we cannot say what the mixture of existing and new rules and institutions will ultimately govern celestial commerce.[89] This means scholarship on space governance will be most useful if it answers which space governance problems can be performed by national agencies without violating international treaty, as well as which problems, although they fall within the scope of a public agency's mandate, are best left to private initiative. The tools of law and economics will be invaluable in understanding these governance problems in theory and suggesting solutions to them in practice. Importantly, we must avoid the "pretense of knowledge"[90] by not trying to write down a set of rules for space governance that do not reflect, and cannot adapt to, the particular circumstances that commercial space entities will face.

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[88] The tax itself will prevent some potential wealth from being created. The dissatisfaction due to the destroyed wealth must be compared to the satisfaction due to achieving a more pleasing distribution of wealth to ascertain whether redistribution is worthwhile.

[89] *See* Salter & Leeson, *supra* note 12, at 593.

[90] Friedrich von Hayek, *The Pretense of Knowledge*, Nobel Memorial Lecture (Dec. 11, 1974), http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/1974/hayek-lecture.html [https://perma.cc/P4ZQ-3YLU].