Alexander William Salter

Settling the Final Frontier: The ORBIS Lease and the Possibilities of Proprietary Communities in Space

Center for Innovative Governance Research article

February 21st 2019

Abstract

The law and economics of space policy has recently become an important research area. In this paper I contribute to the literature on legal frameworks for outer space activities, and specifically space settlement. Article II of the 1967 Outer Space Treaty forbids the extension of state territorial jurisdiction to outer space. Barring revision of this fundamental tenet of international space law, rules for human conduct in space must come from somewhere other than states. I propose privately owned and operated communities (proprietary communities) as a model for space settlement and residence. I survey the mechanisms that make such communities likely to supply good governance. I also explore a model lease for such proprietary communities: the ORBIS lease, drawn up by famed scholar of proprietary communities Spencer MacCallum. I conclude by discussing why the voluntarist model would be expected to outperform other models, as well as implications for state policy.

1 Introduction

On June 30, 2017, President Trump signed Executive Order 13803. This executive order revived the National Space Council, inactive since 1993. Under the chairmanship of Vice President Pence, the council had its first meeting on October 5 of the same year. The revival and activities of the National Space Council reflect a growing public awareness of outer space's importance, both as a source of economic growth from increased commercialization, and as a potential locus of geopolitical conflict.

The resurgence of public sector interest in space occurs simultaneously with increased private sector activity. The total size of the global space economy in 2016 reached approximately $330 billion, up from $323 billion in the previous year. Of this, about $250 billion—75% of total spending—was commercial (Space Foundation 2017). In 2017, the space sector received private equity flows between $2.5 billion and $3.9 billion (Foust 2018), and this figure is likely to grow with the continued commercial development of space technologies. "From commercial launch services to more exotic operations such as space tourism and asteroid mining, private enterprise is shaping up to be a critical driver of outer space activity" (Salter 2018: 2).

The increased importance of space means that space-related questions that were previously speculative, or even imaginary, are suddenly relevant. Perhaps the most salient is space settlement and colonization. With the costs of launch continuing to fall due to innovative companies such as SpaceX, whose successful test of its Falcon Heavy rocket in February 2018 demonstrated that space is becoming steadily easier to access, the question of what human space settlements will look like ought to be addressed sooner rather than later. I provide one answer to this question: *proprietary communities* can and should be a model for space settlement.

Proprietary communities are governance organizations that are privately owned and operated yet are capable of supplying the requisite bundles of collective goods for achieving good governance. I conduct a law and economics analysis of a hypothetical lease for a private celestial community, the ORBIS lease, as a case study to show the mechanisms by which proprietary communities can contribute to good governance in space.

Outer space proprietary communities are promising because they are, by virtue of their internal operation, means-ends consistent institutions for securing good governance. But there are external reasons—reasons not pertaining to proprietary communities as such—that make privately governed communities an attractive vehicle for space settlement. These reasons pertain to the nature and content of international space law, in particular the restrictions on nation-states from extending their sovereignty to the celestial bodies. The 1967 Outer Space Treaty (United Nations 1967), signed by all the major spacefaring nations, remains the most important document shaping the *corpus iuris spatialis* (public international space law). The first two Articles of this treaty suggest significant difficulties for any attempts at space settlement that are spearheaded or overseen by states. The relevant portion of OST Article I reads:

> The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.
>
> Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.

Article II reads:

> Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.

Article II poses the most obvious difficulties for public space settlement efforts. While colonization seems like an inherently public function, Article II seems to present an

insurmountable barrier to states performing this task. Space settlement necessarily entails territorial appropriation, or at least some system of control, for the purposes of exercising oversight. Thus it seems any publicly sponsored attempts at space settlement necessarily involve *de facto* extension of territorial jurisdiction to the celestial bodies. While legal innovations could possibly get around this restriction, it is more likely that any settlement attempts by an advanced spacefaring nation will be met with loud disapproval by others, on Article II grounds. There are also possible Article I grounds for objection, depending on how the benefits and interest clause and the free access clause are interpreted.

But proprietary communities do not have this problem. As private, self-governing communities, they do not represent extensions of state jurisdiction or sovereignty to outer space. While it may be the case that proprietary communities, as commercial ventures stemming from incorporated entities within a terrestrial state, require state authorization for states to be compliant with OST, this does not imply direct state control over these private entities. Still less does it imply states extending their legal reach, in terms of jurisdiction, to the celestial bodies. Proprietary communities thus represent a promising avenue for securing the benefits of space settlement without the costs of potentially acrimonious international law disagreements.

In making my argument, I contribute to several distinct but related literatures. The most relevant is the literature on legal and ethical issues pertaining to space settlement (Billings 2006; Fogg 2000; Milligan 2015; Schmitt 2006; Simberg 2012a, 2012b; Valentine 2012; Wasser and Jobes 2008). The second is the large and growing literature on private activities, especially commerce, in outer space (Buxton 2004; Cooper 2003; Cooper 2009; Feinman 2013; Gorove 1968; Gruner 2004; Hertzfeld and von der Dunk 2005; Irwin 2015; Lee 2000; Linter 2016; Listner 2003; Milligan 2011; Montgomery 2018; Pop 2000; Saletta and Orrman-Rossiter 2018;

Salter 2016, 2018; Salter and Leeson 2016; Sattler 2005; Shaw 2013; Simberg 2012a, 2012b; Tepper 2018a, 2018b; Tronchetti 2014, 2015; von der Dunk 2015, 2017; Wasser and Jobes 2008; Weeden and Chow 2012; White 1998, 2002, 2003; Zell 2006). The third, which is dated but is in the early stages of a revival, pertains to international relations and governance systems in space (Bloomfield 1965; De Man 2017a; Elhefnawy 2003; Jessup and Taubenfeld 1959; Knorr 1960; Krasner 1991; Leib 2015; Peterson 1997; Perry 2017; Szocik et al. 2017; Wijkman 1982). The fourth is the law and economics literature on proprietary and other forms of private communities (Andersson and Moroni 2014; Beito et al. 2002; Bell 2018; Boudreaux and Holcombe 1989; Foldvary 1994; Ellickson 1991; Makovi 2017, 2018; Salter 2016; Stringham 2015), from which I draw several supporting arguments. The final literature is on non-state solutions to governance problems, focusing on how communities without access to an irresistible monopoly enforcer (the state) can provide collective goods and achieve good governance (Anderson and Hill 2004; Boettke 2011; Caplan and Stringham 2008; Ellickson 1991; Friedman 2014; Leeson 2014; Powell and Stringham 2009; Stringham 2015; Stringham and Zywicki 2011).

I organize the remainder of this paper as follows. In Section 2 I discuss the problem of good governance and show how proprietary communities can solve this problem. In Section 3 I conduct a law and economics analysis of the ORBIS lease, which is a hypothetical lease for a private space community that illustrates how many of the mechanisms discussed in Section 2 would work. In Section 4 I discuss problems with other models for space settlements, in particular bureaucratic approaches that would fall under the auspices of public international organizations such as the United Nations. In Section 5 I conclude by briefly recapitulating, discussing the limitations of my analysis, and considering what nation-states can do to support private celestial communities in a manner consistent with treaty obligations.

2 In Search of Good Governance

How should celestial communities be governed? To answer this question, we must make recourse to the social science literature, especially political economy, on governance more generally. The quest for good governance is a search for rules that allow individuals to live among each other peacefully and maximize the benefits associated with specialization under the division of labor (Smith 1776; Mises 1949). Social scientists frequently call these governance mechanisms "institutions," which can be thought of as the "rules of the social game." They structure our conduct, render our behavior intelligible and predictable and, in the best of circumstances, channel individual self-interested behavior into beneficial social outcomes (North 1990). All communities, whether terrestrial or celestial, must solve three "big picture" problems associated with governance in order to flourish. The first two of these can be described as primary problems. These are the direct problems that need to be overcome to achieve successful community governance. The third problem can be described as the secondary problem. It is better understood not as a barrier to be overcome, but as a description of what successful strategies for overcoming the barrier will look like.

2.1 Three Governance Problems

The first problem is the *predation problem*. Perhaps no greater definition exists than that of James Madison in *Federalist 51*: "In framing a government which is to be administered by men over men, the great difficulty lies in this: you must first enable the government to control the governed; and in the next place oblige it to control itself." Government—or rather any provider of governance, which includes the ability to enforce—entails a Faustian bargain (Ostrom 1984). To provide governance, which includes but is not limited to social rule creation and enforcement,

a government must be strong enough for its edicts to have force. But once a government is this powerful, it lends itself to abuse when the individuals who staff the government use it to benefit themselves at the expense of the common good. James Buchanan (1975) stated this problem a slightly different way: the chief political problem is how to enable the protective and productive capabilities of government, while staving off its predatory tendencies. This is the primary problem considered in the economic literature on constitutional design (Buchanan and Tullock 1962), but it applies to all communities, public or private. Some mechanism must exist to prevent governors from preying on the governed, if groups of individuals are to flourish.

The second problem is the *coordination problem*. This problem stems from the fact that human knowledge is necessarily fragmented and dispersed throughout social groups (Hayek 1948, 2002). Although social scientists frequently treat social problems as an exercise in constrained optimization, the data necessary to solve the problem does not exist in a manner that can be harnessed by any one mind, or even any group of minds. This means the quest for good governance necessarily has an *epistemic* dimension. The rules for communal flourishing are not given, but must be discovered, and some mechanism must be available for adapting those rules to changing circumstances when the need arises. One implication of imperfect knowledge is that, aside from questions of incentive-alignment, there is a coordinative role of social institutions that must be fulfilled if communities are to flourish (Hardin 1982, 1989; Lachmann 2007 [1970]; Ordeshook 1992). There are many, many ways for humans to live together peacefully and productively. Which will be chosen and followed? A simple example of this problem is deciding on which side of the road to drive. Whether drivers drive on the right or the left is ultimately socially irrelevant. But it is crucially important that there be some rule specifying left or right, and that drivers know what it is! In brief, there are many instances where

that there *is* a rule in place matters much more than *what* the rule says. Providers of governance need to assist those whom they govern solve these kinds of coordination problems.

The final problem is the *resource problem*. This is the problem of finding cost-minimizing rules (Becker 2017 [1971]; Robbins 2007 [1932]). There are many possible solutions to the predation and coordination problems. But not all of them are equally desirable from the perspective of the governed. It is important to remember that creating and enforcing rules is itself an economic activity, because it involves tradeoffs. Rule creation and enforcement uses resources, and those resources are employed only with a cost—the value of the next best alternative to which those resources could have been directed. Governance providers must solve the predation and coordination problems in a way that minimizes resource costs. In other words, the best solutions to the primary problems will be those that leave the most resources left over, so that the other wants of community members can also be satisfied.

The above problems are institutional, and thus they must have institutional solutions. Social scientists reject out of hand any explanation of good governance that relies on inherently superior individuals finding themselves in positions to govern others. Instead, to the extent that successful strategies for communal living are achieved, the explanation must be that the rules of the game enable the governors and the governed both to coexist peacefully and productively, in a manner that somehow simultaneously embodies solutions to the above problems. A social scientific explanation of how this is done must specify *mechanisms*: those pieces of social technology that align incentives and information, such that individuals find it both in their interest and within their ability to behave in a socially beneficial manner. The next sub-section will explore how proprietary communities solve these problems, and thereby contribute to good governance.

2.2 Proprietary Communities

Proprietary communities are well poised to ameliorate the predation, coordination, and resource problems. Makovi (2018b: 9-10) provides a cogent definition and overview

> A proprietary community is an institution in which governance is provided by the owners of private property to voluntary members and participants. There are two types: land-lease associations and subdivisions. Land-lease entails a landlord's exercise of sole proprietorship over property which is leased to tenants. Examples include apartment complexes, shopping malls, industrial parks, and RV campgrounds. By contrast, examples of subdivision include condominium and homeowners' associations.

While there are important differences between land-lease associations and subdivisions, these are not important for my argument. The key is that proprietary communities are examples of private governance. They are arrangements where the bundle of goods and services, which collectively constitute what we call "governance," are privately provided, based on voluntary individual contract, by an entity that seeks to profit thereby.

Unlike governments, membership in a proprietary community is voluntary, because individual members have a feasible right of exit. If a proprietary community begins to operate in a manner its residents dislike, they can relinquish their membership (Ellickson 1982). Within its territory, a proprietary community resembles a monopoly provider of governance services, like current governments operating on the model of post-Westphalian states. But each resident of the proprietary community has a contract with that community, which must be reached voluntarily (Stringham 2006). This *explicit* voluntary element—as opposed to hypothetically or fictitiously voluntary, as in the case with modern governments that are frequently justified with an appeal to a social contract—combined with ease of exit renders proprietary communities responsive to the demands of its residents in a much more direct fashion than even inclusive, democratic states.

Proprietary communities, or other institutional arrangements for private communities that closely resemble them, have been extensively studied by philosophers and social scientists.

Notable contributions to the literature include Boudreaux and Holcome (1989), Foldvary (1994), Friedman (2014 [1973]), Leeson (2011), MacCallum (1970), and Stringham (2015, 2016). Normatively, Nozick (1974) and Rothbard (2006 [1973]) are often cited by advocates of maximally voluntary governance as an ethical ideal. While these works have generated an extensive secondary literature, there has not yet been significant real-world application of these ideas, at least on a large scale. (Experiments with charter cities and special economic zones are a possible exception; see Bell 2018 and Moberg 2017). The world's surface geography is almost entirely monopolized by states, making the acquisition of territory on which to conduct experiments in consensual government quite difficult. But as mentioned in the Introduction, this makes outer space a potentially exciting environment for the application of private, consensual governance models. At minimum, OST Articles I and II will make it very difficult for states to justify government-led or sponsored settlement projects. These legal restrictions should not be viewed as a hindrance, but an opportunity: they offer humanity the chance to explore alternative ways of living together to achieve human flourishing. Proprietary communities live up to that promise.

2.3 Private Governance as Good Governance: Why it Works

While there are many margins on which proprietary communities can be expected to provide good governance, there are four mechanisms that merit special attention. These mechanisms explain how those who organize and operate proprietary communities acquire the information necessary to govern well, as well as face the right incentives to do so. They also explain why those who consume proprietary community services (its residents) act in a manner conducive to the health of the overall governance arrangement. These mechanisms are: residual claimancy, club goods provision, peaceful dispute resolution, and sorting.

The first mechanism, residual claimancy, is the foundation for the other three. Proprietary communities have *owners*. These owners personally bear the economic consequences of their decisions (cf. Alchian and Demsetz 1973; Demsetz 1972), which is a powerful way to align incentives and information. Depending on the circumstances, these can be groups of property owners who undertake collective action, a single organization that leases properties and manages them according to a centralized and coherent decision-making structure, or some other (albeit less common) arrangement. Residual claimancy establishes strong incentives to provide good governance. If the owner(s) of a proprietary community do not deliver governance services its customers prefer at prices those customers can afford, then the proprietary community will incur losses, thereby destroying social wealth. In the leasing organization example, this will take the simple form of costs in excess of revenues; in collective action scenarios among property owners, such as homeowners associations, the relevant burden will be felt through a reduction in property values. But equally important is the informational role of residual claimancy: profits (good governance) and losses (bad governance) is how proprietary communities ascertain whether they are providing the right mixture of governance services, and whether they are supplying those services in least-cost manner. Even if we assume that the "kinds" of governance are fixed—ruling out innovation for the present thought experiment—it nonetheless remains true that there are multiple ways to supply a given service. If members of a proprietary community expect some form of "public" transportation, what form will it take? Rail? Busses? Toll road construction? Some combination of the above? The profit and loss system afforded by proprietary communities operating in a broader constellation of market prices (Mises 1951 [1922], Hayek 1948) allows those who manage a proprietary

community to discover those governance solutions that best match what residents, potential and actual, desire.

The second mechanism is club goods provision. Those with an economic background may have noticed an assumption in the above argument: that governance services can be priced. But, as critics may argue, while this may be true of some governance services, it is less true of others. For example, the abstract good "law and order" seems to have an element of publicness about it. If this is so, then it is difficult to price the good and meter it out only to those who pay. If those who do not pay for the proprietary community's services can nonetheless enjoy them, then customers have no incentive to pay. Thus, proprietary communities are seemingly left without a way to acquire revenue. Fortunately, there is a way around this objection. Good governance is not a *public good*, but a *club good* (Buchanan 1965). Because the benefits associated with good governance are spatially demarcated—they inherently attach to specific blocks of physical space, such as real estate—governance can be priced by bundling the provision of physical territory with the governance services to be enjoyed. These broader benefits associated with good governance can be priced into the value of the proprietary community's real estate (and hence the lease rate as well, provided the proprietary community embraces that sort of a model). In fact, it is precisely the club-like nature of governance services that make proprietary communities both feasible and attractive as a governance model. This also has implications for tenant or owner-association member behavior: if residents are behaving in a way that imposes costs on others, those in charge of operating the proprietary community have the ability and the incentive to intervene to stop the costly behavior, by resolving the underlying conflict in whatever contributes to the continued viability and profitability of the community.

This segues naturally into peaceful dispute resolution, the third mechanism. Whenever human beings reside in close quarters and interact regularly, they will occasionally come into conflict. Good governance involves ameliorating and resolving these conflicts in a low-cost way. This almost always means as peaceful a way as possible. Violence is socially costly: the resources spent engaging in violence may be privately beneficial for the wielder of violence, but because those resources have an opportunity cost, society is poorer by the real goods and services that could have been produced with the resources that instead went into violence (e.g., Tullock 1967). And of course, violence has the potential to actively destroy wealth, such as in the event of wars, which waste large quantities of labor, capital, and natural resources. Humans make recourse to violence because it is a simple and obvious dispute resolution technology. Although we dislike it, "might makes right" is a viable rule for settling disputes, as thousands of years of human history attest. But it is *not* a viable rule for settling disputes, if our goal is widespread human flourishing, of the kind enjoyed by the Western nations beginning with the Industrial Revolution. One of the most important functions of a proprietary community is to provide an overall framework of rules that is conducive to peaceful dispute resolution. By having a publicly available list of rules and providing a fair process for adjudicating disputes over when and how those rules have been breached—a function that embodies the ideal of the rule of law (Hayek 1960)—proprietary communities help solve one of the omnipresent dilemmas confronting human beings acting in groups, and in a context where the proprietary community organizers have the incentives and information to maintain both an efficient and equitable dispute resolution process.

The final mechanism is sorting. Not all individuals will have the same tastes regarding governance. Some will want to live in a community that offers more extensive services with

either higher property costs or lease prices; others will prefer more minimalist schemes, which will be reflected in lower property costs or lease prices. For example, some proprietary communities may choose to insure residents for fire, theft, or property damage, while others do not. Property costs and lease prices will be higher for those that do, all else being equal. Individuals who are more risk-averse can self-sort into these kinds of communities, while others with greater taste for risk can self-sort into communities that do not bundle residence with these particular insurance schemes. In brief, because proprietary communities are voluntary, individuals will find they can self-sort into the proprietary community that provides their most preferred bundle of governance services at a given price. Economists call this Tiebout competition (Tiebout 1956), or "voting with one's feet." In addition to Tiebout competition there is pseudo-Tiebout competition, which is Tiebout competition extended into the time dimension. Over time, individuals can move switch communities if they find that other communities start offering a better deal. Both Tiebout and pseudo-Tiebout competition contribute to good governance by giving proprietary community residents what they want, either due to abstract preferences, or due to competition between communities trying to attract additional residents.

It is important to note that the efficacy of any of these mechanisms vary depending on the circumstances of time and place. At least in the early stages of space settlement, Tiebout and pseudo-Tiebout competition are probably not going to be all that important (except in comparison to, and in competition with, ordinary terrestrial communities). Nonetheless they all are worth mentioning, because these four mechanisms offer a powerful explanation of why and how proprietary communities will govern in the interests of their residents.

3 From Practical Theory to Theoretical Practice: The ORBIS Lease

The ORBIS lease was written by Spencer H. MacCallum, a noted scholar of private governance and proprietary communities, and the grandson of Spencer Heath, whose *Citadel, Market and Altar* (1957) was itself a pioneering analysis of voluntary societies. Following his grandfather's vision, MacCallum intended the ORBIS lease (MacCallum 1996) to be a practical outline for the establishment of a voluntary community. The goal is an explicit contractual community, where institutionalized coercion (such as taxation and policing) is eliminated, and sporadic coercion (such as violence among residents) is minimized.

The full text of the lease is available at http://voluntaryist.com/backissues/081.pdf. My purpose is to focus on the economic mechanisms—specifically the ones highlighted in the previous Section of this paper—rather than to conduct an exhaustive analysis. I encourage the reader to follow along, consulting the endnotes throughout the lease for helpful background information regarding the how the various covenants within the lease are related to existing legal traditions, as well as explanations for the rationales behind particular covenants.

The first content of note is in the Editor's Note that precedes the lease. Here the editor, quoting from a private document written by MacCallum written some time after the ORBIS lease, reproduces MacCallum's thoughts on the basic principles underlying the covenants within the lease. These principles serve as a hermeneutical key for understanding the document as a whole. They are exactly quoted (from p. 1 of the document) as follows:

1. Public services amply provided through exclusively free-market enterprises without resort to taxation.
2. Community administrators exercising little or no police function.
3. Personal interests of the owners and administrators of the community aligned with the public interest, the common good of the whole community.
4. Flexibility of land use, permitting changes to take place incrementally over time without prejudice to contracted rights.

5. An exact standard by which to determine and measure quantitatively the "good of the community."
6. A cultural bias towards settling differences creatively by means that do not include resorting to physical force.
7. A competitive market free of any and all coercive restraints of trade.

We now turn to the lease proper. The lease is divided into four Sections, each focusing on a different aspect of the leaser-leasee relationship. Section I establishes the nature of the ORBIS community and states its fundamental tenets; Section II contains the specific promises and guarantees ORBIS makes to its leaseholders; Section III contains the specific promises the leaseholders make to ORBIS in turn; Section 4 details tertiary details and commitments.

Section I explicitly establishes ORBIS as a proprietary community on the lend-lease model (as opposed to the subdivision model): ORBIS "is engaged in the business of developing, maintaining and promoting the growth of human environments conducive to the fullest enjoyment of community living, and of marketing such environments by leasing to its members exclusive sites through the occupancy of which they can obtain full access to and enjoyment of the same" (p. 2). The lease is conveyed "in perpetuity to P [the leaseholder], his heirs and assigns, subject to the terms and conditions of this agreement, full membership in the community of ORBIS," which includes exclusive occupancy of a specific physical location, as well as access to common areas, facilities, and amenities.

Section II, which contains six covenants (A-F), focuses on ORBIS's obligation to the leaseholder. Because it defines and limits the scope of governance, it can be thought of as the private analogue of the public constitutions that underlie many liberal democracies. Covenant A contains the important provision that ORBIS "promises not to impose or permit to be imposed within ORBIS any tax on the person or property of P or of anyone else in ORBIS" (p. 2). Covenants B and C pertain to the production and distribution by ORBIS of important

information related to residence within the community, such as health and safety, insurance, technologies for nuisance abatement, and private arbitration as a means of dispute resolution. Covenant B.2 also explicitly contains a reimbursement provision, "through rent remission or otherwise, of uninsured losses resulting from fire, theft, or bodily injury suffered in the public areas of ORBIS, or in the private areas when said fire, theft or attack originated outside those areas and was not caused by the negligence of P or his tenants, guests or invitees" (p. 2). Here we see provisions for the production of two important goods, information and security, which are typically theorized in economics as goods with significant positive external benefits. Furthermore, because these benefits are supposedly non-excludable, meaning it is infeasible to prevent those who do not pay for information from acquiring it, for example, the production of information is held to be an inherently public function, which private markets are not well equipped to handle. These provisions of the lease demonstrate that orthodox theorists lack imagination: it *is* possible for private entities to profit from the production of public goods, such as information or security, by bundling those goods with other goods that are excludable on the basis of payment. In this case, the bundled good is membership within the community, and the profitability of ORBIS's business model is the standard according to which the value of any particular bit of information or any particular security provision is judged. Covenant C promises the collection and publication of information about marketing and land-use values, which serves as a segue to the important following covenant. Covenant D contains the provisions for land use readjustment: the terms on which ORBIS can repossess the leased property, to allocate it to a higher-valued use. This is obviously a risky function, given the power imbalance that frequently characterizes leaser-leasee relationships. To guard against this—which, if ORBIS did not, nobody would have much an incentive to live there!—ORBIS promises to give leaseholders no

less than two years notice, to grand leaseholders the first right of refusal by meeting ORBIS's proposed altered terms, to offer the leaseholder alternative space within the community, to reimburse the full appraised market value to the property made by the leaseholder, to pay the leaseholder's personal and professional moving costs, and to compensate the leaseholder for any loss of business revenue (if the leaseholder used the property for commercial purposes) during the relocation (pp. 2-3). The final two covenants, E and F, are very important because they explicitly state the criteria ORBIS will employ in making its decisions concerning property allocation, as well as what guarantees leaseholders have against negligence or abuse. Covenant E obliges ORBIS "to conduct its business always in a manner calculated to maximize the total value, as income property, of its basic productive capital consisting of the site of ORBIS" (p. 3). Covenant F obliges ORBIS to "have in effect at all times adequate insurance or reserves specifically to compensate P for any loss or inconvenience that P might suffer as a result of ORBITAL [the name used throughout for the corporate owner of ORBIS] violating any of the terms of this agreement." Covenant E establishes the importance and function of ownership as expressed in residual claimancy. The endnote states the purpose of this covenant clearly and concisely:

> The ultimate protection of the members is that Orbital will be operated as a business and hence more rationally than if it were not. If it were operated for any other reason—ideological, charitable, or whatnot—there would not be this protection. The impersonal, rational pricing mechanism of the market is the ultimate safeguard of justice in a civilized community. *The rental income from a proprietary community affords a quantitative measure of its success as a community and a yardstick by which to measure proposed improvements* (p. 5, emphasis added).

Section 3 contains the covenants by leaseholders to ORBIS. Explicit promises of citizens to governments are rare in political constitutions. But it is a standard feature of private contracts. This section concretizes the ORBIS lease as a *private* constitution—an actual, as opposed to a (fictitious) social, contract. The section contains ten covenants (A-J). Some of these are basic

provisions concerning the due date for rent payments, the duty to avoid injuring or causing a nuisance towards other residents, and to carry liability insurance (the converse of the claims which ORBIS guarantees it will insure). The final two covenants, H and J, are particularly important. Covenant H requires residence to "refrain absolutely from engaging in collusion in restraint of trade"; sub-point one of that covenant further requires residents "seek every means of avoiding the use or threat of physical force against any person, for whatever reason" (p. 3). These covenants are linked for a reason: collusion in restraint of trade, enforced by violence, represents a double source of economic inefficiency. First is the inefficiency resulting from monopoly—under-production and over-charging—well known to all economists; second is the inefficiency that arises from investing resources in the capacity to wield violence, itself wasteful because those resources are used not in the service of production but redistribution. As a private community intent on making its residence as pleasant a place to live as possible, thereby contributing to its bottom line, ORBIS obviously has an incentive to prohibit such behavior. Covenant J requires that a resident "be responsible at all times for the actions of his tenants, guests or invitees as if those actions were his own" (p. 3). This is a modern form of a personal surety, where the reputation of a group member serves as a "bond" guaranteeing the adherence to group standards of guests. Since it is infeasible even for a private community to make rules covering every contingency, making residents responsible for guest infractions of the rules *ex post* places an *ex ante* burden on the resident to ensure compliance. This is the least-cost option for the division of authority between ORBIS and its residents regarding the behavior of guests, the employment of which contributes to collective wealth maximization and, hence, the welfare of the community.

The fourth and final section adds additional content to the previous sections and their covenants. Some of the covenants in this section are miscellaneous, but many contain important provisions that specify how certain governance arrangements will function. There are five covenants in this section. The first few deal with the terms of use and rental, specifying the resident's property is completely within the resident's discretion with respect to use (subject to the other terms and conditions in the lease), and detailing the process by which rents will be reevaluated and marked to market. This includes covenants dealing with arrears and eviction, as well as conditions for termination of the lease. Covenant D is particularly important because it states precisely the conditions under which the leaseholder may terminate the agreement, and the conditions under which ORBIS may terminate the agreement. If the agreement is terminated by the resident due to neglect or abuse, ORBIS promises to "safely transport P and anyone else residing at the time on P's premises, together with their personal belongings, to any place of their choosing" (p. 4). This is noteworthy because it partly mitigates the power imbalance between leaser and lease by explicitly committing to a procedure that facilitates Tiebout and pseudo-Tiebout competition. This helps ORBIS maximize its rental income, and hence its capital value: presumably this commitment to help residents exit in the case of neglect or abuse increases their willingness to reside within ORBIS in the first place. The final covenant, E, is worth quoting in full:

> That any dispute with any person in ORBIS that cannot be resolved informally by the parties to it, including any dispute that might arise over the terms of this lease or the performance of either party to it, shall be settled by a mediator or, failing that, a neutral arbitrator in accordance with the rules and regulations of the XYZ Arbitration Association [a filler for a particular organization to be specified later]. The parties agree to be bound by the decisions of the arbitrator.

This final covenant matters a great deal. It is essentially a repudiation of sovereignty, at least in the familiar (post-Westphalian) sense. ORBIS here relinquishes any claim to be the sole

decision-making authority within its jurisdiction, as well as the sole arbitrator of disputes. By committing to an arbitration procedure, ORBIS provides residents another powerful check on the possibility of predation. Of course, ORBIS could in theory ignore this covenant *ex post*, as well as any other covenants in the lease. However, the likelihood of this is extremely low. First, because ORBIS is privately owned and operated for a profit, if it reneges on its agreements, its reputation will be tarnished. Demand for residence within ORBIS will fall, resulting in a decrease in capital (property) value, and hence future profitability. The only scenario in which ORBIS would find this profitable is if the one-time payoff from cheating, preying on, or otherwise abusing its residents is sufficiently high to outweigh the future foregone profits that will follow once it becomes public knowledge that ORBIS cannot be trusted. Because ORBIS, as a residential community, is an extremely long-lived income generator for its owners, the chance that a one-time payoff will exceed the (present discounted) future cash flows that will be sacrificed due to bad behavior is virtually zero. Second, because the operating conditions require ORBIS to maintain no more than a minimal police force—probably no more than that of a sleepy country hamlet in today's developed countries, both in size and function—it is not clear that ORBIS would have the martial advantage necessary to impose its will on its residents, even if it wished to do so.

The ultimate rationale for ORBIS is that, while monopoly in the provision ordinary goods and services is inadvisable, monopoly in the provision of law order, and justice is pernicious. It ought not to be tolerated, if an alternative is possible. Hitherto no other model has been feasible, because the raw coercive power of modern states resulted in states out-competing other forms of governance. But with outer space, due to the unique circumstances surrounding its status in public international law, other models are feasible, and may even be required. The economic

mechanisms embodied in the various sections and covenants of the ORBIS lease show it is well positioned to serve as a governance model for celestial settlement. It can thus serve as a foundation for actual voluntary, contractual arrangements for space settlements, when such settlements become technologically and economically feasible.

4 Problems with Other Models

The ORBIS model has much to commend it. But arguments about institutional efficacy are necessarily comparative. Even if the ORBIS model works well, it would not be the preferred choice for space settlement if alternative institutions work better. In this section, I will argue that the two most likely alternatives to private communities in space are either infeasible or incapable of outperforming the ORBIS model. These two alternatives are: (a) amending public international space law such that states can take an active lead in promoting space settlement, and (b) the granting of authority to public international institutions, such as the United Nations, to oversee space settlement. Because my chief purpose is to highlight the potentials of the ORBIS model, I will keep this section as brief as possible.

4.1 Option One: Amending the Corpus Iuris Spatialis

The simplest and most salient solution involves amending OST. If the problem is that the *corpus iuris spatialis* does not permit the extension of territorial sovereignty to the celestial bodies, why not simply amend the treaty to remove this provision, or create a new treaty specifically focused on settlement? States can obviously promote territorial expansion and colonization—in fact, states may be *too good* at this, given terrestrial experience with state-sponsored colonization efforts—so the easiest thing seems to be to give them the necessary legal authority. Whether or not states are better at this than proprietary communities is debatable, but it is ultimately a

secondary concern. There will be no amendment of OST to permit state-sponsored settlement efforts, because securing the requisite agreement is simply too costly.

The reason this is so is straightforward. Because there is no international super-sovereign, public international space law must ultimately be self-enforcing. That is, it must be voluntarily adhered to by the states that are parties to the various treaties. Furthermore, this agreement has to be unanimous, at least among consenting nations. Thus any change in the international legal framework governing space would require unanimous consent among party states. Many of the parties are not in any meaningful sense spacefaring nations, meaning they have nothing to gain *politically* by revoking the ban on territorial extension of jurisdiction. And even the spacefaring nations—chiefly the United States, Russia, and China—may find the prospect of a renewed "space race," this time for resources and territory, unsettling. Because any proposed change to public international space law would create disproportionate benefits for some states, those states that do not share in the benefits have political reasons to reject them.

This is not just idle speculation; failure to achieve concurrence in international treaties pertaining to space has already occurred. The most famous example is the 1979 Moon Agreement (United Nations 1979). The Moon Agreement is a failed treaty: while it stipulates many changes to the principles governing the use of outer space, it is ultimately toothless because it was signed by none of the spacefaring nations. This was chiefly due to Article 11, which states that the "moon and its natural resources are the common heritage of mankind". This is no mere rhetorical flourish: in international law, "common heritage of mankind" is a specific legal principle that limits the use of defined territorial areas. In this context, states had a reasonable expectation that this language meant the use of the moon, including its surface territory and natural resources, was off-limits to states, except with the explicit permission of

other states. The few nations that had, or could feasibly have, access to the moon obviously had no interest in subordinating their activities to those states that had no such ability. This explains why the United States, the Soviet Union, China, Japan, and many member states of the European Space Agency did not sign.

Thus, there is precedent for significant proposed changes in the *corpus iuris spatialis* to fail, because they were not consistent with state parties' interests. Given the current international legal context, and especially considering the renewed competition between the Untied States, Russia, and China in space-related matters, the required changes to space law necessary for states to support settlement efforts are extremely unlikely.

4.2 Option Two: Delegation of Public Authority

That leaves one other option: states grant to a public international authority, most likely the United Nations, the right to oversee space settlement programs. Within the United Nations, an organization could be set up, perhaps under the auspices of COPUOS (Committee on the Peaceful Uses of Outer Space), that either directly conducts celestial settlement, or grants authority to parties to establish such settlements while actively overseeing and regulating them. While this proposal, and those similar to it, are not without a touch of the heroic and romantic—as are many large-scale proposals for collective action, oftentimes to humanity's loss—it too runs afoul of insurmountable difficulties. The first is the same problem as outlined in 4.1. The United Nations would need to acquire the authority to oversee any settlement activities, whether direct or indirect. It only can acquire that authority from the voluntary consent of member states. But states have political reasons to withhold that consent, for the reasons explored above.

But even if member states consented to such an arrangement, there are inherent problems with these kinds of governance solutions that put them at a disadvantage to modes of private

governance, of which ORBIS is an example. The managerial arrangements practiced by authorities of this kind are *bureaucratic*: they are hierarchical, like private companies, but do not exist in a market context (Niskanen 1968; Tullock 2005). As such, they cannot make use of market prices, and thus profit and loss, as an aid in making their decisions (Mises 1944). This has profound implications for the incentives public governance agents face, as well as the information they have at their disposal. To begin, because bureaucrats do not operate in an organization that is a residual claimant on its mandate, they do not have the same incentives to control costs. In fact, if they are allocated their funds by some other authority, as many bureaucracies are, they have an incentive to exhaust their budget, which is cost-*maximizing* behavior. And because they cannot use market prices to perform profit and loss calculations as a means of ascertaining the efficacy of their rules and operations, they must adhere rigidly to fixed procedures as a substitute, which are necessarily less flexible in the face of changing circumstances. For-profit organizations can adjust procedures when market signals tell them they are no longer effectively servicing customers. If ORBIS experiences a fall in demand for residence, and thus declining rental income, it can experiment with alternative governance strategies (which can alter both on the cost and revenue side of its balance sheet) until the market gives it reliable feedback, via a more favorable bottom line, that it has found a solution in the interests of its residents. A bureaucratic solution to the governance problems associated with space settlement cannot use this tatonnement process, precisely because it is a non-market organization. One result that can, and frequently does, follow in bureaucratic organizations is that various alternative metrics for success are put forth. But these other metrics, whether drawn from ideological or interest-based notions—recalling the quote from the ORBIS lease on page 18 of this paper—will not equally appeal to different bureaucratic stakeholders. Thus interest

groups, each in favor of running the bureaucracy according to their preferred goal, emerge and impair the function of the organization, because they now have two avenues for achieving success: allocating resources to advancing their preferred goal, and allocating resources to impeding rival interest groups' advancement of theirs. In contrast, the shareholders of ORBIS have an easy exit option if they believe the community is no longer being governed in a profit-maximizing manner: sell their ownership stake (and, if the option is available, start selling short!).

To summarize, the problems with bureaucracies (public hierarchies) as opposed to corporate proprietary communities (private hierarchies) can be stated in accordance with the economic mechanisms from Section 2. Bureaucracies have no residual claimants. They thus do not have the incentive to cut costs, nor the information necessary to do so, since their output is not priced in a competitive market. As such, they do not have the ability to provide the bundle of club goods associated with good governance. They can try to provide some goods they anticipate will have club-like qualities, but they will not know whether the current mix actually satisfies consumer demand, or whether the current mix is being produced in a least-cost manner. They also do not lend themselves to a quick and low-cost dispute resolution mechanism. Instead dispute resolution, much like public courts today, will be imprecise and slow. This is due to the absence of cost consciousness on the part of bureaucrats, as well as the heavy reliance on formal procedures that are cumbersome and not well situated to deal with the nuances of particular conflicts. Lastly, the monocentric nature of bureaucratic authority precludes the possibility of competing organizations, and thus the prospects for Tiebout and pseudo-Tiebout competition to discipline the behavior of the bureaucracy are practically nonexistent.

Admittedly, this overview of the problems with bureaucratic governance was brief. But the problems identified in this Section have ample support, both theoretically and empirically, from the vast literature on political economy and nonmarket decision making. Given the legal problems with permitting existing states to spearhead space settlement, and given the economic problems with permitting international bureaucracy to oversee space settlement, the best remaining option is the private community model, of which ORBIS is an exemplar.

5 Conclusion: So What Should States Do?

I have argued that, due to international treaties limiting the extension of state jurisdiction and sovereignty to the celestial bodies, the most feasible model for space settlement is of voluntary, privately owned and operated communities. Furthermore, there are several economic mechanisms that lead us to conclude these proprietary communities will deliver good governance: rules and procedures for peaceful living that meet the demands of resident-consumers. I analyzed a hypothetical lease for a celestial proprietary community, the ORBIS lease, and showed how its provisions and covenants embody the principles of residual claimancy, club goods provision, peaceful dispute resolution, and sorting. This demonstrates the ORBIS lease is a valid model for the governance of future space settlements.

Nonetheless, it remains true that states are the primary actors in space, and thus there are questions about what states should do in light of the prospects of private space settlement. Here we return to OST, this time focusing on Article VI. The relevant portion reads, in part: "The activities of non-governmental entities in outer space, including the Moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty." This suggests a productive role for states in overseeing private space settlement, in

a manner that does not amount to their assertion of *de facto* or *de jure* jurisdiction in space. States can perform an important function by setting minimum standards and qualifications for celestial proprietary communities. These communities will almost certainly be governed under the auspices of a profit-seeking corporation, and these corporations must be incorporated somewhere. The US, for example, could release a clear list of standards and qualifications that for-profit celestial communities must meet before they are granted corporate status, and before any of their claims are permissible for adjudication in a US court. (US courts hearing cases involving celestial communities does not imply territorial jurisdiction, so long as they are not conferring and enforcing titles to real property.)

The model here is one of indirect monitoring. After setting up the initial "rules of the game" in the form of conditions required for celestial corporate entities to be recognized under US law, the government should restrict itself to oversight, rather than actively managing the affairs of these communities. As an example, the government could require corporate celestial communities to post bonds as collateral against potential damages payments to residents, and require corporate celestial communities to disclose crucial operational information to residents in a timely manner. Of course, as we have seen, proprietary communities have an incentive to perform these functions on their own. Thus the role of the state in this case will be one of a watchdog, rather than a traditional regulator.

In addition, states can and should make regular reports concerning their celestial proprietary communities, or rather the corporate entity, to the appropriate international organizations such as the United Nations. By disclosing information to other states in these venues, states have a forum for dialogue concerning their respective corporations that operate private communities in space. This oversight function is in compliance with the "authorization

and continuing supervision" clause of OST Article VI. Furthermore, there is wide leeway in how states perform this function, since Article VI is not self-executing (Montgomery 2018). This is a feature, not a bug: instead of a clumsy, one-size-fits-all requirement, states can and should approach the oversight and disclosure issue concerning their celestial corporate entities in a manner that adheres both to the letter and spirit of OST, while also being alterable as dialogue between states concerning space matters unfolds.

Our experience with states over the last few centuries shows that states best contribute to the common good not when they are active micromanagers, but background enforces of basic rules. When considering the prospects for extraterrestrial human communities, it is appropriate that the state adopt an even more restrained role. But restrained is not synonymous with unimportant. States still have a crucial function to perform in fostering international peace and cooperation, which is one of the background conditions necessary for functional celestial communities. What I have argued here is that, referencing the ORBIS lease as a model, private communities can and should perform many of the governance functions that previously were the state's purview. This frees up public sector resources to focus on what the state is best at: serving as a sometime-referee and arbitrator, rather than an active player or partisan. Prudent and restrained oversight by states in a few key areas can enable private celestial communities to thrive.

References

Alchian, Armen and Demsetz, Harold. 1973. The Property Right Paradigm. *The Journal of Economic History*, *33*(1), pp.16-27.

Anderson, Terry and Hill, Peter J., 1990. The Race for Property Rights. *Journal of Law and Economics* 33(1), pp. 177-197.

Anderson, Terry and Hill, Peter J., 2004. *The Not so Wild, Wild West: Property Rights on the Frontier*. Stanford University Press.

Andersson, David Emanuel and Stefano Moroni, eds. 2014. *Cities and Private Planning: Property Rights, Entrepreneurship, and Transaction Costs*. Cheltenham: Edward Elgar.

Becker, Gary. 2017 [1971]. *Economic Theory*, 2nd edition. New York: Routledge.

Beito, David T., Peter Gordon, and Alexander Tabarrok (eds.). (2002). The Voluntary City: Choice, Community, and Civil Society. Ann Arbor: University of Michigan Press.

Bell, Tom W., 2017. *Your Next Government?: From The Nation State to Stateless Nations*. Cambridge: Cambridge University Press.

Benson, Bruce L., 2011 [1990]. *The Enterprise of Law: Justice Without the State.* (2nd Ed). The Independent Institute.

Billings, Linda. 2006. How Shall We Live in Space? Culture, Law, and Ethics in Spacefaring Society. *Space Policy* 22(4), 249-255.

Bloomfield, Lincoln P., 1965. Outer Space and International Cooperation. *International Organization*, *19*(3), pp.603-621.

Boettke Peter J., 2011. Anarchism and Austrian Economics. *New Perspectives on Political Economy* 7 (1): 125–140.

Boudreaux, Donald J., and Randall G. Holcombe. (1989). "Government by Contract." Public Finance Quarterly 17(3): 264-280.

Buxton, Carol R., 2004. Property in Outer Space: The Common Heritage of Mankind Principle vs. The First in Time, First in Right, Rule of Property. *Journal of Air Law and Commerce* 69(4), 689-708., 69, pp.689.

Buchanan, James M. 1965. "An Economic Theory of Clubs." Economica, 32(125): 1-14.

Buchanan, James M. 1975. *The Limits of Liberty: Between Anarchy and Leviathan*. Chicago: University of Chicago Press.

Buchanan, James M and Gordon Tullock. 1962. *The Calculus of Consent: Logical Foundations of Constitutional Democracy*. Ann Arbor: University of Michigan Press.

Caplan, Bryan and Stringham, Edward.P., 2008. Privatizing the Adjudication of Disputes. *Theoretical Inquiries in Law*, *9*(2), pp.503-528.

Cooper, Lawrence A., 2003. Encouraging Space Exploration Through a New Application of Space Property Rights. *Space Policy*, *19*(2), pp.111-118.

Cooper, Nikhil D., 2009. Circumventing Non-Appropriation: Law and Development of United States Space Commerce. *Hastings Constitutional Law Quarterly* 36(3), 457-482.

De Man, Philip. 2017a. State Practice, Domestic Legislation and the Interpretation of Fundamental Principles of International Space Law. *Space Policy*, *42*, pp.92-102.

De Man, Philip. 2017b. The Exploitation of Natural Resources in Outer Space. In *Outer Space Law: Legal Policy and Practice*, Yanal Abul Failat and Anél Ferreira-Snyman, eds., pp. 243-2555. Surrey: Globe Law and Business.

Demsetz, Harold. 1967. Towards a Theory of Property Rights. *American Economic Review* 57(2), pp. 347-359.

Elhefnawy, Nader. 2003. Territorializing Space? Revisiting an Old Idea. *Astropolitics*, *1*(2), pp.55-63.

Ellickson, Robert C. 1982. "Cities and Homeowners Associations." University of Pennsylvania Law Review, 130(6): 1519-1580.

Ellickson, Robert C., 1991. *Order Without Law*. Harvard University Press.

Erlank, Wilan. 2017. "Property and Ownership in Outer Space." In *Outer Space Law: Legal Policy and Practice*, Yanal Abul Failat and Anél Ferreira-Snyman, eds., pp. 1-14. Surrey: Globe Law and Business.

Feinman, Mathew. 2013. Mining the Final Frontier: Keeping Earth's Asteroid Mining Ventures from Becoming the Next Gold Rush. *Pittsburgh Journal of Technology Law and Policy* 14(2), 202-[i].

Fogg, Martyn J. 2000. The Ethical Dimensions of Space Settlement. *Space Policy* 16(3), 205-211.

Foldvary, Fred, (1994), Public Goods and Private Communities: The Market Provision of Social Services. Aldershot, England / Brookfield, Vermont: Edward Elgar.

Foust, Jeff. 2018. How Long Will the Money Keep Flowing? *The Space Review*. Accessed 7 February 2018. Available Online At: http://www.thespacereview.com/article/3425/1

Friedman, David. 2014. *The Machinery of Freedom: Guide to a Radical Capitalism* (3rd Ed.). Open Court Publishing Company.

Friedman, David. 2000. *Law's Order: What Economics has to do with Law and Why it Matters*. Princeton: Princeton University Press.

Gorove, Stephen. 1968. Interpreting Article II of the Outer Space Treaty. *Fordham Law Review* 37(3), 349-354.

Gruner, Brandon C., 2004. A New Hope for International Space Law: Incorporating Nineteenth Century First Possession Principles into the 1967 Space Treaty for the Colonization of Outer Space in the Twenty-First Century. *Seton Hall Law Review* 35(1), 299-358.

Hardin, R. 1982. Collective action. Baltimore: Johns Hopkins Press.

Hardin, R. 1989. Why a constitution? In B. Groffman and B. Wittman, eds., The federalist papers and the new institutionalism. New York: Agathon Press.

Hayek, Friedrich August. 1948. *Individualism and Economic Order*. Chicago: University of Chicago Press.

Hayek, Friedrich August. 2002 [1968]. "Competition as a Discovery Procedure." Lecture sponsored by the Institut für Weltwirtschaft at the University of Kiel. Marcellus S. Snow, trans. *Quarterly Journal of Austrian Economics* 5(3), pp. 9-23.

Hertzfeld, Henry R. and Von Der Dunk, Frans G., 2005. Bringing Space Law into the Commercial World: Property Rights Without Sovereignty. *Chicago Journal of International Law* 6(1), 81-100.

Irwin, Thomas R., 2015. Space Rocks: A Proposal to Govern the Development of Outer Space and its Resources. *Ohio State Law Journal* 76(1), 217-246.

Jankowitsch, Peter. 2015. "The Background and History of Space Law." In *Handbook of Space Law*, Frans van der Dunk and Fabio Tronchetti, eds, pp. 1-28. Cheltenham: Edward Elgar.

Jessup, Philip C. and Taubenfeld, Howard J., 1959. Outer Space, Antarctica, and the United Nations. *International Organization*, *13*(3), pp.363-379.

Johnson, Christopher Daniel. 2017. "International Law Governing Outer Space Activities." In *Outer Space Law: Legal Policy and Practice*, Yanal Abul Failat and Anél Ferreira-Snyman, eds., pp. 1-14. Surrey: Globe Law and Business.

Kirzner, Israel. 1973. *Competition and Entrepreneurship*. Chicago: University of Chicago Press.

Knorr, Klaus. 1960. On the International Implications of Outer Space. *World Politics*, 12(4), pp.564-584.

Krasner, Stephen D., 1991. Global Communications and National Power: Life on the Pareto Frontier. *World Politics*, 43(3), pp.336-366.

Lachmann, Ludwig M. 2007 [1970]. *The Legacy of Max Weber*. Auburn: Ludwig von Mises Institute.

Lee, Ricky J., 2000. Reconciling International Space Law with the Commercial Realities of the Twenty-First Century. *Singapore Journal of International Comparative Law* 4(1), 194-251.

Leeson, Peter T. 2011. "Government, Clubs, and Constitutions." Journal of Economic Behavior & Organization, 80(2): 301-308.

Leeson, Peter T., 2014. *Anarchy Unbound: Why Self-Governance Works Better Than You Think*. Cambridge University Press.

Leib, Karl, 2015. State Sovereignty in Space: Current Models and Possible Futures. *Astropolitics*, *13*(1), pp.1-24.

Libecap, Gary D. and Wiggins, Steven N., 1984. Contractual Responses to the Common Pool: Prorationing of Crude Oil Production. *American Economic Review* 74(1), pp. 87-98.

Linter, Andrew, 2016. Extraterrestrial Extraction: The International Implications of the Space Resource Exploration and Utlilization Act of 2015. *Fletcher Forum of World Affairs* 40(2), 139-158.

Listner, Michael J., 2003. The Ownership and Exploitation of Outer Space: A Look at Foundational Law and Future Legal Challenges to Current Claims. *Regent Journal of International Law* 1, 75-94.

Listner, Michael J., 2017. "Special Issue on Asteroid Mining." *The Precis*, XII. Newsletter of Space Law and Policy Solutions.

Locke, John. 1824 [1691]. *Two Treatises of Civil Government* (*The Works of John Locke*, Vol. 4). London: Rivington. Available online at: http://oll.libertyfund.org/titles/763.

Lueck, Dean. 1995. The Rule of First Possession and the Design of the Law. *Journal of Law and Economics* 38(2), pp. 393-436.

Lueck, Dean. 1998. "First Possession." In *The New Palgrave Dictionary of Economics and the Law*, ed. Peter Newman, pp. 132-144. London: Palgrave Macmillan.

MacCallum, Spencer Heath. 1970. The Art of Community. Menlo Park, California: Institute for Humane Studies.

Makovi, Michael. 2017. The Anarcho-Calculus of Consent: Proprietary Communities as a Substitute for the State. Working paper. Available online at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2944516

Makovi, Michael. 2018a. Cookie Cutter Covenants: Regulation-Induced Homogeneity of Homeowners Associations. Working paper. Available online at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3194419

Makovi, Michael. 2018b. Government vs. Governance: Libertarianism and Private Communities. *Journal of Private Enterprise*, forthcoming.

Milligan, Tony. 2015. Rawlsian Deliberation About Space Settlement. In *Human Governance Beyond Earth*, 9-22. Charles S. Cockell, ed. Springer.

Milligan, T., 2011. Property Rights and the Duty to Extend Human Life. *Space Policy*, *27*(4), Pp.190-193.

Moberg, Lotta. 2017. *The Political Economy of Special Economic Zones: Concentrating Economic Development*. London: Routledge.

Montgomery, Laura. 2018. US Regulators May Not Prevent Private Space Activity on the Basis of Article VI of the Outer Space Treaty. Mercatus Center Working Paper. Available online at: https://www.mercatus.org/system/files/montgomery-outer-space-treaty-mercatus-working-paper-v1.pdf

Mises, Ludwig Von. 1949. *Human Action: A Treatise on Economics*. New Haven, Conn.: Yale University Press.

Mises, Ludwig Von. 1951 [1922]. *Socialism: An Economic and Sociological Analysis*. New Haven: Yale University Press.

North, Douglass C., 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.

Nozick, Robert. 1974. Anarchy, State, and Utopia. NY: Basic Books

Ordeshook, P. C. 1992. Constitutional stability. Constitutional Political Economy 3(2): 137- 175.

Ostrom, V., 1984. Why governments fail: an inquiry into the use of instruments of evil to do good. In: Buchanan, J.M., Tollison, R.D. (Eds.), Theory of Public Choice II. University of Michigan Press, Ann Arbor, pp. 422–435.

Perry, Ian B., 2017. Law of Space Resources and Operations on Celestial Bodies: Implications for Legislation in the United States. *Astropolitics*, 15(1), pp.1-26.

Peterson, Mark J., 1997. The Use of Analogies in Developing Outer Space Law. *International Organization*, 51(2), pp.245-274.

Pop, Virgiliu. 2000. Appropriation in Outer Space: The Relationship Between Land Ownership And Sovereignty on The Celestial Bodies. *Space Policy*, *16*(4), pp.275-282.

Powell, Benjamin. and Stringham, Edward P., 2009. Public Choice and the Economic Analysis of Anarchy: A Survey. *Public Choice, 140*(3-4), pp.503-538.

Robbins, Lionel. 2007 [1932]. *An Essay on the Nature and Significance of Economic Science*. Auburn: Ludwig von Mises Institute.

Rothbard, Murray N. (1973) 2006. For a New Liberty: The Libertarian Manifesto. 2nd ed., Auburn: Ludwig von Mises Institute

Saletta, Morgan Sterling and Kevin Orrman-Rossiter. 2018. Can Space Mining Benefit All of Humanity? The Resource Fund and Citizen's Dividend Model of Alaska, the 'Last Frontier.' *Space Policy* 43(1), 1-6.

Salter, Aelxander. 2016a. Political Property Rights and Governance Outcomes: A Theory of the Corporate Polity. *Journal of Private Enterprise* 31(4), 1-20.

Salter, Alexander W. 2016b. Post-Cameralist Governance: Towards a Robust Political Economy of Bureaucracy. *Economic Affairs* 36(3), 294-308.

Salter, Alexander W. 2016c. Space Debris: A Law and Economics Analysis of the Orbital Commons. *Stanford Technology Law Review* 19(2), 221-238.

Salter, Alexander W. 2017. Ordering the Cosmos: Private Law and Celestial Property Rights. *Journal of Air Law and Commerce* 82(2), pp. 311-322.

Salter, Alexander W. and Leeson, Peter T. 2014. Celestial Anarchy: A Threat to Outer Space Commerce? *Cato Journal* 34(3), pp. 581-595.

Sattler, Rosanna. 2005. Transporting a Legal System for Property Rights: From the Earth to the Stars. *Chicago Journal of International Law* 6(1), 23-44.

Schmitt, Harrison. 2006. *Return to the Moon: Exploration, Enterprise, and Energy in the Human Exploration of Space*. New York: Springer

Shaw, Lauren E., 2013. Asteroids, the New Western Frontier: Applying Principles of the General Mining Law of 1872 to Incentive Asteroid Mining. Journal of Air Law and Commerce vol. 78, no. 1 (Winter 2013): p. 121-172.

Simberg, Rand. 2012a. Homesteading the Final Frontier: A Practical Proposal for Securing Property Rights in Space. *Issue Analysis, 3*. Available Online at: https://cei.org/sites/default/files/rand%20simberg%20-%20homesteading%20the%20final%20frontier.pdf

Simberg, Rand. 2012b. Property Rights in Space. *The New Atlantis*, pp.20-31.

Simmons, Thomas E. 2015. Deploying the Common Law to Quasi-Marxist Property on Mars. *Gonzaga Law Review* 51, pp. 101-154.

Smith, A. 1981[1776]. An Inquiry into the Nature and Causes of the Wealth of Nations. Indianapolis: Liberty Fund.

Space Foundation. 2017. "Press Release: Space Foundation Report Reveals Global Space Economy at $329 Billion in 2016." Accessed 7 February 2018. Available Online At: https://www.spacefoundation.org/news/space-foundation-report-reveals-global-space-economy-329-billion-2016.

Stringham, Edward P., 1998. Market-Chosen Law. *Journal of Libertarian Studies* 14(1), pp. 53-77.

Stringham, Edward P. 2006. "Overlapping Jurisdictions, Proprietary Communities, and Competition in the Realm of Law." Journal of Institutional and Theoretical Economics (JITE) / Zeitschrift für die gesamte Staatswissenschaft, 162(3): 516-534.

Stringham, Edward P., 2015. *Private Governance: Creating Order in Economic and Social Life*. Oxford University Press, USA.

Stringham, Edward P. And Zywicki, Todd J., 2011. Hayekian Anarchism. *Journal of Economic Behavior & Organization*, *78*(3), pp. 290-301.

Szocik, Konrad, Wójtowicz, Tomasz and Baran, Leszek. 2017. War or Peace? The Possible Scenarios of Colonising Mars. *Space Policy*.

Tepper, Eytan. 2018a. Sherriff Elon Musk? Who Will Govern Human Space Habitats, and How. *Space Review*, 21 May. Available online at: http://www.thespacereview.com/article/3498/1

Tepper, Eytan. 2018b. Structuring the Discourse on the Exploitation of Space Resources: Between Economic and Legal Commons. *Space Policy*, forthcoming.

Tronchetti, Fabio. 2014. Private Property Rights on Asteroid Resources: Assessing the Legality of the ASTEROIDS Act. *Space Policy*, *30*(4), pp.193-196.

Tronchetti, Fabio. 2015. The Space Resource Exploration and Utilization Act: A Move Forward or a Step Back? *Space Policy* 34: 6-10.

Tullock, Gordon. 1967. The Welfare Costs of Tariffs, Monopolies, and Theft. *Economic Inquiry* 5(3), 224-232.

United Nations. 1967. "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies." Accessed

7 February 2018. Available Online at: http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html.

United Nations. 1979. "Agreement Governing the Activities of States on the Moon and Other Celestial Bodies." Accessed 16 August 2018. Available online at: http://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/intromoon-agreement.html.

Valentine, David. 2012. Exit Strategy: Profit, Cosmology, and the Future of Humans in Space. *Anthropological Quarterly* 85(4), 1045-1067.

Von der Dunk, Frans. 2015. "International Space Law." In *Handbook of Space Law*, Frans van der Dunk and Fabio Tronchetti, eds, pp. 29-126. Cheltenham: Edward Elgar.

Von der Dunk, Frans. 2017. Asteroid Mining: International and National Legal Aspects. *Michigan State International Law Review* 26(1), pp. 83-102.

Wasser, Alan, and Jobes, Douglas. 2008. Space Settlements, Property Rights, and International Law: Could a Lunar Settlement Claim the Lunar Real Estate it Needs to Survive. *Journal of Air Law and Commerce* 73(1), 37-80.

Weeden, Brian C. and Chow, Tiffany. 2012. Taking a Common-Pool Resources Approach to Space Sustainability: A Framework and Potential Policies. *Space Policy*, *28*(3), pp.166-172.

White, Wayne N., 1998. Real Property Rights in Outer Space. In *Proceedings, 40th Colloquium on the Law of Outer Space* (Vol. 370). Available Online at: http://www.spacefuture.com/archive/real_property_rights_in_outer_space.shtml.

White, Wayne N., 2002. The Legal Regime for Private Activities in Outer Space. In E. L. Hudgins (Ed.) *Space: The Free-Market Frontier*, pp. 83–111. Washington: Cato Institute.

White, Wayne N., 2003. Interpreting Article II of the Outer Space Treaty. In *54th International Astronautical Congress. Bremen, Germany: International Astronautical Federation*.

Wijkman, Per Magnus. 1982. Managing the Global Commons. *International Organization*, *36*(3), pp.511-536.

Williams, Stephen F., 1983. The Requirement of Beneficial Use as a Cause of Waste in Water Resource Development. *Natural Resources Journal* 23(1), pp. 7-23.

Zell, Jeremy L., 2006. Putting A Mine on The Moon: Creating An International Authority to

Regulate Mining Rights in Outer Space. *Minnesota Journal of International Law* 15(2), 489-520.