world trade institute

The Political Economy of Subsidizing Space Commerce

Ronald B. Davies
Joseph Francois
Rodrigo Polanco

WTI working paper no. 2/2026

b
UNIVERSITÄT
BERN

cite as Davies, R., J. Francois and R. Polanco (2026). "The Political Economy of Subsidizing Space Commerce," in R. Davies, J. Francois, and R. Polanco eds., Regulating Space-Based Commerce: Insights from Economics and International Economic Law, Hart:Bloomsbury Publishing, Oxford, forthcoming.

The Political Economy of Subsidizing Space Commerce*

Ronald B. Davies† Joseph Francois‡ Rodrigo Polanco§

Abstract

Much like the exploitation of global trade by the first multinationals, early space commerce has the potential to lead to significant conflict as privateers seek to use force to capture resources from others. Governments currently subsidize research increasing such disruptive capabilities despite the fact that international law makes governments – not firms – liable for damages. We show that this can be explained in a political economy setting where the potential possibility of conflict affects the terms of an agreement outlawing them. In essence, by increasing the conflict capabilities of one's own firms, this enables a government to push for a more favourable treaty. We demonstrate that under plausible assumptions, this works to the benefit of technologically-advanced nations. Thus, subsidizing current space activities is likely to cement current international income inequality.

JEL classification: F51, F53, H25, K20

Keywords: Outer Space; Subsidies; Treaty formation.

*We thank participants at the 2024 Law and Economics of Space-Based Commerce Workshop, the 2024 Skatteforsk workshop, the 2024 International Institute for Public Finance Congress, the 2024 GTAP workshop, the 2024 European Trade Study Group conference, the 2025 RETHINK workshop, the Joint Research Council, and the Central Bank of Ireland for useful comments. Financial support from The Research Council of Norway (Grants 325720 and 352981) is gratefully acknowledged. All errors are our own.

†Corresponding author. University College Dublin, School of Economics and Skatteforsk. Email: ronald.davies@ucd.ie

‡World Trade Institute. Email: Joseph.Francois@unibe.ch

§World Trade Institute and Swiss Institute of Comparative Law. Email: Rodrigo.Polanco@unibe.ch

1 Introduction

We are currently at the beginning of a second space race. What distinguishes this race from that of the 1960s and 1970s is the level of private sector involvement. Well-known companies such as SpaceX and Virgin Galactic – as well as lesser-known firms like Northrop Grumman Innovation Systems, Astrobotic Technology, and Intuitive Machines – are operating in near-Earth orbit and working to extend their reach to the Moon.[1] In addition to the companies operating off-planet, there are hundreds of private firms designing and manufacturing for space missions, providing launching services, operating orbital communications systems, and even training private astronaut crews. This has created an industry valued at more than $384 billion in 2022 (Bryce, 2022). Further, with single asteroids like Psyche 16 being valued a $100 quintillion, this high-cost, high-risk industry is likely to grow faster (Sohn, 2023). Finally, familiar terrestrial concerns about abuse of excess market power and anti-competitive behaviour are manifesting themselves in the emerging private space marketplace. An example is the SpaceX domination of the commercial launch market (Lipton, 2024) which can lead to concerns over both access to space and the distribution of the gains from such activities.

Currently, this private activity is largely supported by government funding. Figure 1 illustrates the amount different countries spend on space projects, with the US leading with $62 billion in 2022. A significant amount of this goes to private companies via government contracts and outright subsidies. For example, since 2015 SpaceX has received over $15 billion in government contracts and captured nearly 5% of the US government's space spending in 2022. Indeed, without such support, SpaceX would have failed before it successfully left the ground (Peterson, 2022). Although such subsidies can be justified as supporting the development of beneficial R&D, it would be naive to assume that such funds do not simultaneously support the development of technologies with less benign prospects. In

[1] See https://brycetech.com/ for an overview of the industry and its major companies.

particular, one can imagine scenarios where firms use government-funded technology to hinder their competitors. Such activities can be mundane (e.g. spreading malicious code or stealing of trade secrets) or quasi-military (e.g. blockading shipping lanes or seizing cargo). This interacts in with current space law in two meaningful ways. First, although the Outer Space Treaty (OST) of 1967 limits the militarization of space it says nothing regarding private militias or security forces. Second, the OST makes governments – not private actors – liable for damages in space, seemingly opening governments to risk without an offsetting benefit. Here, we analyse one such benefit, namely, how current subsidies influence future international agreements on space commerce because of how subsidies encourage private rent-stealing efforts.

Although rent-stealing actions such as stealing secrets or blocking routes may seem to violate the norms of contemporary business practice, it must be remembered that the rule of law in space is both weakly defined and activities are very difficult to monitor. This setting parallels the situation at the time of the first multinational firms. From the 17th through the mid-19th century, companies such as the East India Company engaged in commercial exploitation of colonies and faced few consequences for their actions, either at home or abroad. As a result of this weak law enforcement, many firms operated their own private military forces. For example, at one point the East India Company maintained a force of over 260,000 soldiers (Lawson, 1993). These forces were not solely for defence but were also used to seize competitors' assets. Furthermore, these seizures were often state-sanctioned via letters of marque and reprisal, a distinction that distinguishes between legal privateering and outright piracy. That said, as the intensity of the conflicts rose, the private gains from privateering were outweighed by the gains from cooperation.[2] This led to the Paris Declaration Respecting Maritime Law, which was signed in 1856, an agreement which banned letters of marque and ended privateering.[3]

[2] This was also helped by the desire to stamp out non-government sanctioned actors, i.e. actual pirates.
[3] ICRC, Declaration Respecting Maritime Law. Paris, 16 April 1856, https://ihl-databases.icrc.org/en/ihl-treaties/paris-decl-1856.

Currently, space commerce looks set to repeat this pattern. Under the OST and the Registration Convention, all space objects must be registered with an Earth-bound government.[4] Thus, each private actor in space is bound to an Earthly government. Furthermore, under the rules of the treaty, the registered government of a space agent – not the agent themselves – is liable for any activities in the sovereign-free domain of space. Thus, if one space company were to plunder another, it is up to the government of the latter to seek recompense from the government of the former. If damages are awarded, it is then up to the offender's government to seek repayment from the offender. If it does not do so, then this is implicitly sanctioning space privateering. Furthermore, Article II of the Outer Space Treaty specifies that "outer space, including the moon and other celestial bodies, is not subject to national appropriation", meaning that no one can claim to "own" property in space. Given the combination of high-value resources and imprecise legal rights, the situation seems ripe for potential conflict between space-faring corporations.

If this is the case, why then are governments providing supports which can lead to damaging activity which they themselves would be liable for? In this chapter, we provide one potential answer, namely, that the development of hindering technologies alters the eventual negotiations which will establish more formal property rights in space.[4, 5] By developing its firms' capabilities to win corporate conflicts, this increases a government's payoff without a treaty. As such, this improves its ability to capture rents when treaty terms are bargained over. Note that since Article IV of the OST explicitly states that space will be used "exclusively for peaceful purposes", such aggressive actions by member states would be prohibited whereas those of private agents are not explicitly proscribed. Thus, this gives governments a specific

[4] This treaty is formally known as the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and other Celestial Bodies, of 27 January 1967. As of 2023, the OST has 113 parties, including all the major space-faring nations. The regulation on registration is in Article VIII and reaffirmed in the Convention on Registration of Objects Launched into Outer Space (1975), commonly known as the "Registration Convention". United Nations Office for Outer Space Affairs (UNOOSA), Space Law Treaties and Principles, https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties.html.

[5] Under the Outer Space Treaty, space is a "province of mankind" or "common heritage of mankind", which in similar terms is also referred to the seabed and the ocean floor in law of the sea (UN, 1982). As such, no government or private person can lay claim to a celestial body.

rationale for supporting those activities by private rather than public entities.

To lay out this argument, we use a simple game theoretic model with two countries, each of which has one private firm. In the first stage, each government announces a subsidy for their firm which lowers the cost of building "gunships", i.e. lowers the cost to their firm of engaging in disruptive rent-stealing activity. This subsidy both increases the potential size of their own gunship fleet and, by shifting the cost function for their firm, can reduce the size of the other country's fleet. Intuitively, this is akin to creating a first-mover advantage for their firm. Knowing the outcome without an agreement to ban the use of gunships, in the second stage the two governments agree to a treaty that both bans privateering and agrees to a split of the resources in space. By providing a greater subsidy to their firm, a government is thus able to influence the treaty negotiating process by ensuring their dominance in the "might makes right" non-treaty situation.

We show that, in equilibrium, both countries will subsidise their own firm, a finding that mirrors current practice among the space-faring countries. Further, we show that under fairly reasonable assumptions, the country with a cost advantage in building gunships will gain the most from the treaty because they have a natural advantage in the no-treaty situation. A similar result would come about if the country instead had a lower opportunity cost to providing subsidies to their firm. This then suggests that, contrary to the optimistic vision laid out in the Outer Space Treaty, the riches of space will likely be captured by current technological leaders such as the US. This would then likely further exacerbate the international inequalities already in place.

In the next section, we present our model. Section 3 provides some policy implications and concludes.

2 The Model

We begin by describing the overall setup of the model before deriving results for various sub-games and arriving at a characterization of the model as a whole.

Consider the following game with two governments, each of which with one firm. Denote these as home and foreign (with foreign variables denoted by *s). The structure of the game is such that, in the first stage, each government chooses a subsidy which lowers the marginal cost of building military capability. Although we present this as building gunships, the model can encompass any investment in rent-capturing efforts. Following this, the two governments negotiate a treaty that splits the total resources between them and prohibits the building of military capabilities.[6]

Denote the total value of space resources by c. Under the terms of the treaty, a fraction ϕ of this will be given to home with the remainder going to foreign. This fraction will be decided via a Nash bargaining game where α is the relative bargaining strength of home.

In the absence of the treaty, firms are able to build gunships g and engage in piracy. The home after-subsidy (s) cost of building gunships is $(1-\mathrm{s})\mathrm{m}(\mathrm{g})$ which is increasing and convex in g. Assume that $m(0) = m'(0) = 0$. Further, assume that home has a cost advantage so that $m'(g) \geq m^{*\prime}(g)$ with strict inequality for $g > 0$.

These gunships are used in battle both to protect one's own cargo and pirate from the other. Battle is modelled as a Tulloch (1980) contest for c, so that the probability of the home firm winning is non-deterministic and given by $\frac{g}{g+g^*}$. . Thus, home's expected revenues are given by $\frac{\mathrm{g}}{\mathrm{g}+\mathrm{g}^*}\mathrm{c}$.[7]

The payoff for each country is its firm's profits less the cost of any subsidies. The game is solved via backwards induction, requiring us to solve for the equilibrium payoffs under piracy to determine the split of resources under the treaty and then, finally, the subsidy used by each government.

2.1 Piracy Equilibrium

[6] Note that this is military capabilities of *firms*. The Outer Space Treaty already bans the militarization of space, that is, such activities by *governments*.

[7] Although it is not necessary, one can interpret the game as where each firm starts with a portion of c which it tries to protect from the other while trying to pirate the other firm's share. So long as battles are independent, then this amounts to the same formulation used here.

Given the above, the home firm's payoff without a treaty is:

$$\pi = \frac{g}{g + g^*} c - (1 - s) m(g) \quad (1)$$

while that of the foreign firm is:

$$\pi^* = \frac{g}{g + g^*} c - (1 - s^*) m^*(g^*) \quad (2)$$

From Equation 1, the home firm will invest in gunships until the marginal expected benefit equal the subsidized marginal cost of gunship production:

$$\frac{g^*}{(g + g^*)^2} c - (1 - s)\, m\,'(\mathrm{g}) = 0. \quad (3)$$

comparable condition holds for the foreign firm:

$$\frac{g}{(g + g^*)^2} c - (1 - s^*)\ m\ *\,'(g^*) = 0. \quad (4)$$

We now state our first result regarding the piracy sub-game.

Proposition 1. *The Nash equilibrium in the absence of a treaty will have both firms producing gunships. This then results in lower joint profits than when no gunships are produced.*

Proof. Note that as long as , then $g^* > 0$, g will be positive. Since the reverse is true for the foreign firm and the cost of gunships is for both, there exists a Nash equilibrium in which both produce positive, yet finite, numbers of gunships. If $g^* = 0$, then the home firm will still desire a positive, if minuscule amount of firepower as this guarantees it will capture all of the resources, implying that zero gunships by both is not a Nash equilibrium. Finally, as the total amount of revenue (c) is irrespective of how many gunships are produced, total profits are necessarily lower in this Nash equilibrium when compared to the situation in which no gunships are produced.

This result that the no-treaty outcome is a less than net zero situation is a variant on what Francois (2008) calls the "bar-fight" equilibrium. Note that the same result would hold if

battle destroys some of the space resources since this would mean that they are fighting over a price less than c.

For notational simplicity, define:

$$\Omega = (1-s)(1-s^*)(g+g^*)^3(2m'\mathrm{m}^{*\prime\prime} + 2m^{*\prime}m'' + (g+g^*)m''\ m^{*\,\prime\prime}) + c(g+g^*)\big((1-s)m' + (1-s^*)m^{*\prime}\big) > 0 \quad (5)$$

then, using Equation 3 and its foreign counterpart, we can show that:

$$\frac{dg}{ds} = \Omega(1-s^*)(g+g^*)m\ '(2m^{*\prime} + (g+g^*)m^{*\prime\prime}) > 0 \quad (6)$$

so that as the subsidy to the home firm increases, so too does its fleet of gunships. This same increase, however, has an ambiguous effect on the foreign firm where:

$$\frac{dg^*}{ds} = \Omega(g+g^*)m'\big((1-s)m' - (1-s^*)m^{*\prime}\big) \quad (7)$$

Here, there are two forces at play. On the one hand, an increase in the home subsidy which leads to more home gunships gives the foreign firm a stronger incentive to invest in its own fleet in order to protect its cargo. At the same time, however, the large home battlefleet lowers the chance foreign will win. This lowers its expected gain from battle, leading to divestment. Which of these dominates is a function of the relative marginal cost of the two firms. If the home marginal cost is high, meaning that it has fewer gunships to begin with, then a higher home subsidy will not increase the number of home gunships much, leading foreign to bolster its own defences. Alternatively, if the home marginal cost is low and it has a large, sizable fleet, the foreign response will be to reduce its costs rather than fight harder against an already formidable opponent. This is summarized in our second proposition.

Proposition 2. *If the equilibrium, after-subsidy cost of home is lower than that of foreign, then the home subsidy will lower foreign gunship production and a higher foreign subsidy will expand home gunship production. If the reverse is true, then these effects are flipped accordingly. Note that as a consequence, at most one country will be able to reduce the size*

of the other's fleet via their own subsidy. Finally, in the absence of subsidies, the home government will be the one able to reduce the other's fleet via its own subsidy.

Note that this final point derives from the assumed home cost advantage. For future use, define $\tilde{s}^*(s)$ as the foreign subsidy where $(1-s)\,m'(g) = 1 - \tilde{s}^*(s))m^{*\prime}(g)$, that is, where the after-subsidy marginal cost is equal when producing the same amount. Note that given the home cost advantage, that $\tilde{s}^*(s) > s$ for all s.

Thus, without a treaty, the home government's expected payoff is $W = \frac{g}{g+g^*}c - m(g)$ and foreign expects to receive $W^* = \frac{g^*}{g+g^*}c - m^*(g^*)$ where g and g^* are functions of the subsidies as determined by the first order conditions.

2.2 Terms of the Treaty

As noted above, under the treaty, home will receive ϕc with the rest accruing to foreign. Since the subsidies are only paid when gunships are built, neither government incurs subsidy costs under the treaty. This then implies that under the Nash bargaining solution, ϕ is chosen to maximize:

$$\alpha ln\left(\phi c - \frac{g}{g+g^*}c + m(g)\right) + (1-\alpha) ln\left((1-\phi)c - \frac{g^*}{g+g^*}c - m^*(g^*)\right). \tag{8}$$

Taking the derivative with respect to ϕ, we find that:

$$\phi = \frac{g}{(g+g^*)} + \frac{\alpha m^*(g^*) - (1-\alpha)m(g)}{c}. \tag{9}$$

meaning that in equilibrium, the home government's payoff will be:

$$U = \frac{g}{g+g^*}c + \alpha m^*(g^*) - (1-\alpha)m(g) \tag{10}$$

while that of the foreign government will be

$$U^* = \frac{g^*}{g+g^*}c - \alpha m^*(g^*) + (1-\alpha)m(g). \tag{11}$$

Knowing this, each government chooses their subsidy in the first stage in order to maximize their own payoff.

2.3 Optimal Subsidy

We now are able to describe the best response subsidy for each country. The best response for home will be defined by:

$$\frac{dU}{ds} = \left(\frac{g^*}{g+g^*}c - (1-\alpha)m'\right)\frac{dg}{ds} + \left(\alpha m^{*\prime} - \frac{g}{g+g^*}c\right)\frac{dg^*}{ds} \tag{12}$$

or, using the two firms' first order conditions:

$$\frac{dU}{ds} = \big((1-s) - (1-\alpha)\big)m'\frac{dg}{ds} + \big(\alpha - (1-s^*)\big)m^{*\prime}\frac{dg^*}{ds}. \tag{13}$$

Similarly,

$$\frac{dU^*}{ds^*} = \big((1-s^*) - \alpha\big)m^{*\prime}\frac{dg^*}{ds^*} + \big((1-\alpha) - (1-s)\big)m'\frac{dg}{ds^*}. \tag{14}$$

9

From this, we can prove several things about the equilibrium.

Proposition 3. *No subsidies cannot be an equilibrium.*

Proof. Suppose that $s = s^* = 0$. Since the home firm has a cost advantage, the foreign fleet will shrink as home raises its subsidy. Thus, Equation 13 is unambiguously positive. This arises from two things. First, by offering a subsidy, it is in essence conveying a first mover advantage to its firm by encouraging it to build more gunships in the case of no treaty, a motive akin to that found in, e.g., Brander and Spencer (1985), Leahy and Neary (1999), or Davies (2013). Second, by reducing the size of the foreign fleet, this further increases the probability that home wins in battle. Together, these lower the foreign government's no-treaty payoff, tilting the bargaining game in home's favour. Thus, no subsidies by either country cannot exist as a Nash equilibrium.

An implication of this result is that the treaty will have bite, that is, there will be a benefit to the governments cooperating. Also, note that if home were to use a zero subsidy, it is unclear whether foreign would introduce a subsidy or a tax ($s^* < 0$). This is because there is conflict between its desire to generate a first mover advantage for its firms (the first term in 14) via a subsidy and its desire to reduce the home fleet (the second term) which it can only do via a tax on its own firm.

This then leaves us with three possible Nash equilibria as described in our next proposition.

Proposition 4. *Pure Nash equilibria will either be such that, where capital letters denote equilibrium values:*

1. $S = \alpha$ *and* $S^* = 1 - \alpha$,
2. $\alpha < S < \tilde{s}^*(S) < S^* < 1 - \alpha$, *or*
3. $S < min\{\alpha, \tilde{s}^*(S)\}$ *and* $S\text{^} * > max\{1 - \alpha, \tilde{s}^*(S)\}$.

If the home bargaining strength is no less than that of foreign, i.e. $\alpha \geq 0.5 \geq 1 - \alpha$, *then the first of these will be the unique Nash equilibrium.*

10

Proof. There are nine possible cases for Nash equilibria. We will go through each in turn.

1. $S = \alpha$ and $S^* = 1 - \alpha$: In this case, both Equations 13 and 14 are equal to zero. Note that this will always exist as a Nash Equilibrium.

2. $S = \alpha$ and $S^* < 1 - \alpha$: In this case, Equation 14 is strictly positive, implying that the foreign country will increase its subsidy until Case 1 is arrived at.

3. $S = \alpha$ and $S^* > 1 - \alpha$: In this case, Equation 14 is strictly negative, implying that the foreign country will lower its subsidy until Case 1 is arrived at.

4. $S > \alpha$ and $S^* = 1 - \alpha$: In this case, Equation 13 is strictly negative, implying that the home country will decrease its subsidy until Case 1 is arrived at.

5. $S < \alpha$ and $S^* = 1 - \alpha$ In this case, Equation 13 is strictly positive, implying that the home country will increase its subsidy until Case 1 is arrived at.

6. $S > \alpha$ and $S^* < 1 - \alpha$: In this case, Equation 13 requires that $\frac{dg^*}{ds} < 0$ to equal zero while Equation 14 requires that $\frac{dg}{ds^*} > 0$ to equal zero. Each of these requirements necessitates that $S^* > \tilde{s}^*(S)$ where recall that $\tilde{s}^*(S) > S$ due to home's cost advantage. Combined with the conditions describing Case 6, this means that $\alpha < S < \tilde{s}^*(S) < S^* < 1 - \alpha$, which itself requires that $\alpha < 0.5 < 1 - \alpha$. Thus, this possibility requires that the foreign country has greater bargaining strength.

7. $S < \alpha$ and $S^* < 1 - \alpha$: In this case, Equation 13 requires that $\frac{dg^*}{ds} > 0$ to equal zero while Equation 14 requires that $\frac{dg}{ds^*} > 0$ to equal zero. Since it is not possible that both of these are true, this cannot exist as a Nash equilibrium.

8. $S > \alpha$ and $S^* > 1 - \alpha$: In this case, Equation 13 requires that $\frac{dg^*}{ds} < 0$ to equal zero while Equation 14 requires that $\frac{dg}{ds^*} < 0$ to equal zero. Since it is not possible that both of these are true, this cannot exist as a Nash equilibrium.

9. $S < \alpha$ and $S^* > 1 - \alpha$: In this case, Equation 13 requires that $\frac{dg^*}{ds} > 0$ to equal zero while Equation 14 requires that $\frac{dg}{ds^*} < 0$ to equal zero. Since it is not possible that both of these are true, this cannot exist as a Nash equilibrium. Each of these requirements necessitates that $S\hat{} * > \tilde{s}^*(S)$ which is itself greater than *S* due to home's cost advantage. Combined with the conditions describing this case, this requires that $S < min\{\alpha, \tilde{s}^*(S)\}$ and $S\hat{} * > max\{1 - \backslash alpha, \tilde{s}^*(S)\}$. Using these two conditions, this implies that it must be that $\alpha < 0.5 < 1 - \alpha$. Thus, this possibility requires that the foreign country has greater bargaining strength.

Finally, since Cases 6 and 9 require that $\alpha < 1 - \alpha$, if home's bargaining power is no less than foreign's then Case 1 will be the unique Nash equilibrium.

Although simple, this model provides insight into the political economy of subsidies and the ultimate terms of the treaty. This model can be extended in various ways. For example, rather than a production cost advantage, we could build in a differential cost to the government of providing subsidies. For the country that finds it relatively easy to raise funds, they will be able to provide a higher subsidy and achieve greater production of gunships than the other country, arriving at a similar outcome. Another alternative would be to introduce "freight" ships to the model, that is, firms must incur a cost to exploit the resources both with and without a treaty. This can be further complicated by allowing the subsidy to affect the cost of building freighters as well as gunships. Nevertheless, the benefits of encouraging overproduction of one's own fleet of both productive and destructive ships would remain as would the ability to use one's own subsidy to discourage the creation of the other's fleet. Similarly, we could introduce damages from battle, i.e. rather than having revenues constant at *c*, they could be a decreasing function of the number of gunships created by home or foreign. This would give an additional benefit to the treaty but would still mean that there is an incentive to use the subsidy to manipulate the outcome of the no-treaty situation. Finally, we could have a longer, multi-stage game in which, for example, subsidies occur before resources are exploited. This would introduce a role for differences in the discount rate to affect the equilibrium. Nevertheless, the factors we focus on in our succinct model would remain at

12

play.

2.4 Welfare Implications

The above tells us that, unless foreign's bargaining power is sufficiently large – that is bigger than both home's bargaining power and $\tilde{s}^*(S)$ – that the equilibrium subsidies will equal their bargaining strengths. Here we focus on some implications arising from this equilibrium where home has a cost advantage and no bargaining disadvantage.

In particular, in this equilibrium, $g > g^*$, i.e. home will build the larger gunship fleet in the absence of the treaty. In addition, the first order conditions given by Equations 3 and 4, we see that

$$\alpha m^{*\prime}(g^*) = \frac{g}{g^*}(1-\alpha)m'(g) \tag{15}$$

which, since $g > g*$ implies that $\alpha m*' > (1-\alpha)\, m'$ and thus $\alpha m* > (1-\alpha)\, m$. Taking this result to the equilibrium division of resources under the treaty found in Equation 9, we can see that the first term is greater than 0.5 and the second is positive. Therefore, in this Nash Equilibrium, the home country receives more than half of the resources.

This advantage arises from two factors. First, as is obvious, if home has a larger bargaining power, it is able to capture more resources in the treaty. Second, and less obvious, is that its cost advantage enables it to use the subsidy to both boost its own payoff *and* lower its opponents in the absence of an agreement. This latter persists even if there is no difference in bargaining power.

3 Policy Implications and Conclusions

The increasing role of private actors in the utilization of space is arguably the defining feature of the current space race. This does not, however, imply that governments have no active hand in the current situation or its likely development. Indeed, in addition to their own direct actions via national and international space agencies, many governments support private activities via subsidies and government contracts. Given that some of those supported

13

activities may be aimed at capturing rather than creating economic rents, this raises questions about the motivations behind their support for wasteful and damaging activities. These questions are particularly relevant given the assignment of liability and restrictions on public use of outer space under the Outer Space Treaty and other agreements.

In this chapter, we present one possible explanation for such subsidies, namely, that by supporting the capability of its private agents to dominate the space economy a government is better able to dictate the terms of agreements that divvy up the benefits of space. In particular, the model suggests that nations with large bargaining power in those negotiations and pre-existing cost advantages in space activities are those likely to gain greater shares of space resources.

Looking at the current situation, this does not paint an optimistic picture for achieving the Outer Space Treaty's declaration that space shall be used "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" (Article I). Instead, our model suggests that those nations which currently dominate space activity – namely the United States, China, Russia, and to a much lesser extent, the European Member states – will be those who are able to dictate the future distribution of resources (Figure 1). In short, current might makes future right. This has significant implications as it suggests that current inequalities in technological progress for Earthbound economic activities are likely to be exacerbated as more governments representing firms at the technological frontier subsidize their already advantaged firms.

14

References

[1] Brander, J., Spencer, B., 1985. Export subsidies and international market share rivalry. Journal of International Economics 18, 83–100.

[2] Bryce Tech, 2023. The 2022 Global Space Economy at a Glance. https://brycetech. com/ Accessed 12 Feb. 2024.

[3] Davies, R.B., 2013. The silver lining of red tape. Journal of Public Economics 101, 68-76.

[4] Francois, J. 2008. Firms Behaving Badly: International Regulation of Anti-competitive Behavior. Mimeo.

[5] Lawson, P. 1993. The East India Company: A History. Milton Park: Routledge.

[6] Leahy, D. and J.P. Neary. 1999. Learning by Doing, Pre-commitment and Protection. Review of Economic Studies 66, 447-474.

[7] Lipton, E. 2024. Elon Musk Dominates Space Launch. Rivals Are Calling Foul. New York Times, https://www.nytimes.com/2024/05/28/us/politics/ elon-musk-space-launch-competition.html Accessed 28 May 2024.

[8] Peterson, Becky. 2022. Inside SpaceX's Lucrative New Government Satellite Program. https://www.theinformation.com/Accessed 12 Feb. 2024.

[9] Sohn, R. 2023. Metal asteroid Psyche has a ridiculously high "value". But what does that even mean? https://space.comAccessed 12 Feb. 2024.

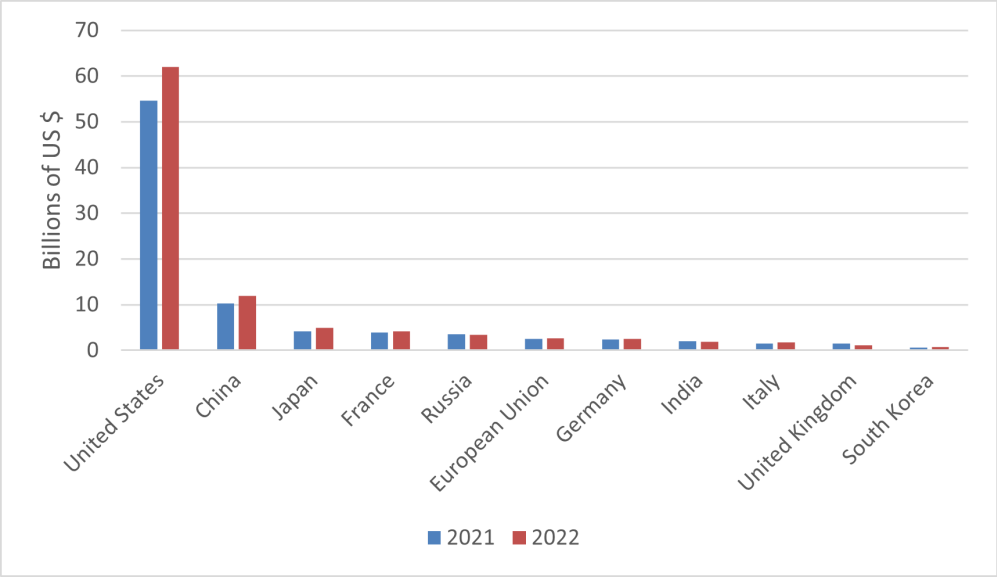
[10] Statista, 2024. https://www.statista.com/statistics/745717/ global-governmental-spending-on-space-programs-leading-countries/.

[11] Tullock, G., 1980. Efficient rent seeking. In: Buchanan, J.M., Tollison, R.D., G.T (Eds.), Towards a Theory of the Rent Seeking Society. Texas A&M University Press, 97–112.

[12] United Nations. 1982. Convention on the Law of the Sea, Dec. 10, 1982, 1833 U.N.T.S. 397.

16

Figure 1: Spending on Space Programmes by Country



Notes: Data comes from Statista (2024).

17