Applying FinTech Economic Models to Space Commerce

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The new frontier of digital, blockchain-backed currency as a vehicle for financial transactions has produced a cascade of economic models iterating solutions to a fundamental problem: The need to incentivize innovation, enable merchants, and reward the builders and maintainers of infrastructure, all outside the operational sphere of traditional, state-demarcated commercial arenas. We illustrate the parallels between this problem and the challenges facing those interested in the transnational commercialization of space, and highlight the mistakes and lessons learned of early cryptocurrency structures and their application to the future of space commerce.

I. Why Consider FinTech?

At first glance, space commerce and fintech seem as disparate as two economic sectors could be; one seems almost imaginary, like the intersection of computer science and creative accounting; the other consisting of real, flying objects visible above us at all times, accented by the roar of rocket engines on huge metal structures. But take a step back, and the social challenges facing these two emerging markets are strikingly similar. How will future governments account for imports, exports, tariffs, and trade regulations – all historically based on borders and line of demarcations drawn on a two-dimensional map? Quick consideration reveals that the answer is not as simple as keeping track of where a payload launches and where it lands.

How will space infrastructure, with its enormous costs and profound risks, evolve from international missions and academic collaboration into something resembling a free market, with the competitiveness and "creative destruction" that accompanies it? While fintech has been asking for the past decade, "how can we improve the accounting by removing the stuff?", space companies have been preparing to build stuff without the accounting. These inherent challenges will become dramatically more noticeable and problematic as the number of players in the space commerce sector grows out of infancy.

Common concerns include the equity of shared human resources among First and Third World nations, the potential overlap between space commerce and military application, and the implications for ongoing political and economic power struggles. Fintech has taken not only a philosophical standpoint – that new resources should be distributed equally by an unbiased, centralized actor – but taken strides towards engineering a practical, virtual model for enforcing such a model in the face of preexisting world powers.

II. A Brief History of Blockchain and Web3

The early, foolhardy premise of the first cryptocurrency, Bitcoin – to supplant the world's banking establishment – was no doubt born out of a lack of insight into the complexities of the challenge. One foundational goal, to curb arbitrary inflation, later proved limiting as early "miners" of blockchain cryptographic hashes received exponential returns within the Bitcoin network on the computational work required to calculate them (not to be confused with any real-world currency or material value), disincentivizing would-be entrepreneurs and creating a nearly insurmountable barrier to entry. Later cryptocurrencies adopted more sophisticated work-reward structures to balance the interests of miners and networks – those running the machines; holders – those seeking to use the coin as a value reserve; and users – merchants and consumers looking for an easier, more anonymous ways to conduct business. The post-

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pandemic era saw the rise of NFTs and virtual "real estate" in the "metaverse", rampant speculation on the value of various crypto coins, marketplaces, securities – or very similar instruments. Now, the sector has drawn the attention of regulatory agencies, who stepped in dramatically with high fines and penalties, in some cases shutting down crypto business, and leading to the arrest of crypto mogul Sam Bankman-Fried in 2022 on charges of fraud.

III. Applications to Space Commerce

A. Legal and Political Implications

In 2019, the world's most expensive military, the United States Armed Forces, founded its eighth independent branch, the Space Force. While the Unites States has historically taken the initiative to combat naval piracy in international waters as a global peacekeeper, it has made no such commitment to enforcing any specific model of justice or legality above the Kármán Line. Despite attempts to organize treaties governing space operations, there has been little action by any nation or international body to enforce the ideas laid out by the United Nations and member nations.

Regarding commercial space ventures, apart from private agreements among companies and governmental organizations, the foundation for rights and responsibilities has been determined though the satellite's launch site. The US has issued fines for private companies launching satellites without US permission; but there has been little for other nations. For example, the Chinese operation to deploy satellite destroying missiles created with space debris at the hail of nobody and condemnation of the whole spacefaring community. Within this gap of legal actions, there is potential for an international body to enforce the rules of satellite launches and space debris. This governing body would be enabled with the powers to facilitate launches and levy charges. While the United Nations exists as a political conglomerate to ensure sensible actions between members, there is a stark lack of an interceding group for space action.

Space craft tracking is already hosted through numerous private venues, but space debris is still held primarily under government control, such the US's Department of Defense Space Surveillance center. While notable attempts to detect space debris exist, there is no one universal system. By allowing access to launch sites only with compliance of laws governing space craft activity, such as designated crash areas for deactivated satellites; space debris tracking can be privatized. Recent projects to create of private launch pads in Texas and Arizona, U.S.A., demonstrate an advance towards the creation of private launch support and groups.
site. With a network of launch sites and providers there are numerous checks that align with protecting our skies

Similarly, financial operations in the digital age have faced a slew of regulatory challenges at the global scale; some reflecting the inertia of outdated methods, some reflecting new ethical dilemmas yet to be resolved. The anonymous nature of cryptocurrency necessitated the consideration of security as a function of structure, rather than external enforcement, as a foundational design consideration. The resulting methods and ideology offer insight into novel ways of incentivizing public and private space agencies to "play fair" by respecting common resources, such as minimizing orbital debris, and mitigating the risk to integrated systems of cascading failures in the event of malicious intent on the part of a few bad actors.

One factor is the ability to quickly and automatically detect non-compliant behavior and move to quarantine the subject, whether it be a satellite suffering from malfunctioning hardware, or operating under deliberate instruction from a controller. Implementing these failsafe at the systemic design level is critical for space commerce, where activities take place at a range that makes it infeasible or impractical for commercial users to directly respond in a reasonable time frame. Such measures can facilitate fair, cooperative market behavior, as well as slow the need for states to bring military power to bear in space to ensure commercial safety and security.

B. Economic Advantages: Centralized vs Decentralized Approaches

Just as fintech faces the challenge of ultimately relating business done in a remote digital network to material transactions in the real world, future space commerce will need to address the issue of how to represent and accumulate the value of business done in relatively remote space back to areas of human population. This is, of course, Earth, for the foreseeable future. Even in the advent of space colonization, it is certain that extraterrestrial human populations would be concentrated in specific, distant places, from earth orbit and beyond. The novel methodologies pioneered by web3 fintech represent valuable paradigms for planning how space commerce may be efficiently organized in the future. With a greater number of potential launch site owner working in cooperation, there is less need for a government controlled and funded site. With a greater number of cooperating communication and control systems, there is less risk of catastrophic failure.

One notable innovation from web3 fintech was the application of "gas fees"; attaching a designation to virtual transactions based on a representation of how much of a network's resources it consumes over its lifespan. This

designation can be used to "tax" transactions in various ways proportional to the total cost of the transaction to all parties of the network. A similar approach lends itself to space commerce for earthside governing agencies to calculate value-added tax or regulatory fees. The simplest approach might be based on farthest distance traveled from a centralized hub, but a more sophisticated and efficient model would be based on the total delta-v of a given payload. By using these metrics for the value-added by transportation firms as well as the resources consumed from infrastructure, taxes, costs, and fees can be adjusted to appropriately compensate publicly-held firms, who might operate key launch and recovery sites; recoup the costs to society of negative externalities, such as space debris; and levy traditional taxes for state governments; all without unduly disincentivizing entrepreneurial risks with sufficiently profitable outcomes that might lead to innovation and social benefit.

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