

“The Resurrection of Malthus: space as the final escape from the law of diminishing returns.”

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Abstract

If there is a self-sustaining space economy, which is the goal of the International Lunar Decade, then it is a subject of economic analysis. Economics is a field with many sub-fields. We make the case for space economics as a field defined by the physical and temporal attributes of the space domain (distant, long duration, boundless) coupled with the virtual absence of human agents and very limited laws and conventions governing actions of economic agents. The Outer Space Treaty proscribes sovereign ownership of cosmic bodies and defines them as a commons – the common heritage of mankind.

The immediate challenge of space economics then is to conceptually demonstrate how a space economy could emerge and work where markets do not exist and few human agents may be involved, in fact where human agents may transact with either human agents or robotic agents or robotic agents may transact with other robotic agents.

1. Background

In 1798, Thomas Malthus predicted humans had approached a precipice and were set to drop over its edge. Population growth was set to intersect with the limits of nature (law of diminishing returns). Yet, precisely at the point of his prediction, a set of contingent variables were in play that launched humans in the opposite direction (toward unprecedented expansion and for many, prosperity). Today, we find ourselves at the Malthusian moment again. Will we find answers to the law of diminishing returns? Humans will either escape the gravitational pull of nature’s limits and challenges to innovation, or they will fail the test of thriving into the future. Space provides both the means by which we can overcome our new Malthusian moment. The

challenges will be how to find the political will to do so and the related problem of how to pay for it.

The two chief challenges facing us going forward, are the end of cheap nature and the productivity crisis. Ultimately, both can be solved by accelerating our return to space. The political will must be found for doing so, but so must ways of financing it.

Innovation is hampered by the materials needed for creating productivity and quality of life enhancing technologies. Many of these materials require rare earth metals that could block the development and spread of new technologies. Asteroids and other astral bodies contain minerals that could solve material constraints imposed by nature. Moreover, the vast technological challenges to accessing the wealth of space would require innovations that later could be commercialized, thereby advancing both productivity and quality of life.

The question is how to pay for it? Governments, as previously stated, the past four decades cut taxes, thus making less money available for research. Moreover, even as tax rates were lowered, offshore finance grew, thus further eroding public revenues. At first, tax cuts were funded by more public borrowing. But, as bond holders grew uncomfortable with this arrangement, governments eventually reduced spending. At the same time, supply-side policies were eroding wages under the banner of ‘flexibility.’ Thus, the puzzle was presented of how to sustain economic demand in an environment where both wages and public spending were under assault? The answer provided in the 1990s was expansion of private debt. This too inflated up to the point where it was no longer sustainable and saw its crescendo in the 2008 financial crisis. Thereafter, policymakers decided upon austerity: the twin contractions of both public and private debt. The effort worked imperfectly, ironically preventing total

economic disaster, but well enough to slow growth. This economic environment can't provide the vast resources needed to fund science sustaining basic research at our universities, let alone the comparatively smaller resources needed for their application to building space hardware.

There are four possible means by which the return to space could be achieved:

1) Independent investors. We see some of this today, but it's mostly limited to a few billionaires as vanity projects and/or as expression of some genuine vision. While helpful, the sums required to accelerate the return to space far exceed the capacity of this group to alone fund both it and the basic research required to advance it.

2) New financial instruments. The challenge is how to make investment in space more profitable than, say, real estate, or financial markets flooded with quantitative easing produced cash. Such instruments would have to provide the means by which long-term investments in space, where the returns would take more than a generation to materialize. Of course, long-range investments are already funded, but one must convince markets that the returns would come and in quantities needed to justify investor returns now.

3) Modern Monetary Theory. If money can be created in the trillions of dollars and euros to fund global efforts to stabilize financial markets without generating inflation, then the same could be done to finance science and space. Given the limits of taxation in today's environment, it may be that governments simply begin funding infrastructure by creating credit on computer keyboards. Automatic triggers could be put in place to reign in this spending upon inflation hitting set targets.

4) Combinations of the above. Government guarantees coupled with outright grants parallel to public private partnerships as with COTS (Commercial Orbital Transportation Services).

financial instruments, monetary policy and billionaire entrepreneurs leveraging public resources to drive down costs and risks of activities in space while continuing to expand the range of opportunities for public and private investment.

Space economics is the study of commercial activities in space in an environment where all resources are defined by the Outer Space Treaty as an international commons to be utilized for the benefit of all mankind. This raises major challenges for a field that has largely evolved studying economic activity under varying degrees of private ownership and capitalism.

Conclusions

We are again at a Malthusian turning point. But the world is awash in capital seeking higher returns. Higher returns can be made possible through significant expansion in research and space development involving a combination of new