**1NC**

**T**

**Interpretation – the affirmative must only garner offense from a defense of the resolutional statement.**

**“Resolved” before a colon reflects a legislative forum**

**Army Officer School 4** (5-12, “# 12, Punctuation—The Colon and Semicolon”, http://usawocc.army.mil/IMI/wg12.htm)

The colon introduces the following: a.  A list, but only after "as follows," "the following," or a noun for which the list is an appositive: Each scout will carry the following: (colon) meals for three days, a survival knife, and his sleeping bag. The company had four new officers: (colon) Bill Smith, Frank Tucker, Peter Fillmore, and Oliver Lewis. b.  A long quotation (one or more paragraphs): In The Killer Angels Michael Shaara wrote: (colon) You may find it a different story from the one you learned in school. There have been many versions of that battle [Gettysburg] and that war [the Civil War]. (The quote continues for two more paragraphs.) c.  A formal quotation or question: The President declared: (colon) "The only thing we have to fear is fear itself." The question is: (colon) what can we do about it? d.  A second independent clause which explains the first: Potter's motive is clear: (colon) he wants the assignment. e.  After the introduction of a business letter: Dear Sirs: (colon) Dear Madam: (colon) f.  The details following an announcement For sale: (colon) large lakeside cabin with dock g.  A formal resolution, after the word "resolved:" Resolved: (colon) That this council petition the mayor.

**The appropriation of outer space means permanently taking property**

**Gorove, LLM, 69** [Stephen Gorove, LLM & PhD Philsophy@Yale. "Interpreting Article II of the Outer Space Treaty." Fordham L. Rev. Vol. 37, Issue 3, pp. 349, published 1969, https://ir.lawnet.fordham.edu/cgi/viewcontent.cgi?article=1966&amp;context=flr] HWIC

With respect to the concept of appropriation the basic question is what constitutes "appropriation," as used in the Treaty, especially in contradistinction to casual or temporary use. The term "appropriation" is used most frequently to denote the taking of property for one's own or **exclusive use with a sense of permanence**. Under such interpretation the establishment of a permanent settlement or the carrying out of commercial activities by nationals of a country on a celestial body may constitute national appropriation if the activities take place under the supreme authority (sovereignty) of the state. Short of this, if the state wields no exclusive authority or jurisdiction in relation to the area in question, the answer would seem to be in the negative, unless, the nationals also use their individual appropriations as cover-ups for their state's activities.5 In this connection, it should be emphasized that the word "appropriation" indicates a taking which involves something more than just a casual use. Thus a temporary occupation of a landing site or other area, just like the temporary or nonexclusive use of property, would not constitute appropriation. By the same token, any use involving consumption or taking with intention of keeping for one's own exclusive use would amount to appropriation.

**A private entity is**

**Cornell Law nd** <https://www.law.cornell.edu/definitions/uscode.php?width=840&height=800&iframe=true&def_id=6-USC-625312480-168358316&term_occur=999&term_src=title:6:chapter:6:subchapter:I:section:1501>

(A) In general Except as otherwise provided in this paragraph, the term “private entity” means any person or private group, organization, proprietorship, partnership, trust, cooperative, corporation, or other commercial or nonprofit entity, including an officer, employee, or agent thereof.

**Violation:**

**TVA: Our interp is compatible with them reading a topical cybernetics aff abt how private space appropriation accelerates**

**B. Our Offense**

**They destroy engagement – predictable stasis ensures research accessibility and negative ground. Even if public policy isn’t the best focus for activism, it’s crucial for dialogue because it’s grounded in consistent reporting and academic work.**

**Two impacts -**

**1] Changing the topic post facto structurally favors the aff by manipulating balance of prep – vote neg because debate is a competitive game that’s meaningless without substantive constraints.**

**2] Also key to have well-prepared opponents. Exclusionary rule: They transform debate into a monologue which means their arguments are presumptively false because they haven’t been subjected to well researched scrutiny.**

**Their model creates a structural disincentive to substantial research. Failure to defend the resolution allows them to shift their advocacy to the terms most favorable to them – causes dogmatism and forces the neg into generics at the margins of the literature – destroys good scholarship.**

**Drop the debater on T, we’ve proven in-round abuse – the round is already skewed from the beginning because their advocacy excluded my ability to generate NC offense– letting them sever doesn’t solve**

**Theory is an issue of competing interpretations because reasonability invites arbitrary judge intervention based on preference rather than argumentation and encourages a race to the bottom in which debaters will exploit a judge’s tolerance for questionable argumentation.**

**Independently, extra-topical offense is a voting issue – lets them infinitely spike out of disads/cps and kills predictability**

**Filter their impacts through predictable testability and model comparison---debate inherently judges relative truth value by whether or not it gets answered---a combination of a less predictable case neg, the burden of rejoinder, and them starting a speech ahead will always inflate the value of their impacts, which makes non-arbitrarily weighing whether they should have read the 1ac in the first place impossible within the structure of a debate round so even if we lose framework, vote neg on presumption. They also create a moral hazard that leads to affs only about individual self-care so even if you think this aff is answerable, the ones they incentivize are not, so assume the worst possible affirmative when weighing our impacts.**

**Case**

**vote neg on presumption – if all information can be used for capital the aff is no diff - example**

**The role of the judge is to be an “independent policy analyst”. This means you should prioritize pluralism and problem-solving theory**

**Desch, PhD, 2-27-19**

**(Michael C., IR@ND, https://www.chronicle.com/article/How-Political-Science-Became/245777)**

Concern that social science has disengaged from practical affairs is not new. Books like Robert Staughton Lynd’s 1939 Knowledge for What? and Ian Shapiro’s 2005 Flight From Reality in the Human Sciences sounded the alarm. And yet, left to their own devices, professors tend to resolve tensions between rigor and relevance by favoring the former. In an influential book on research design, Gary King, Robert Keohane, and Sidney Verba stipulate that "a proposed topic that cannot be refined into a specific research project permitting valid descriptive or causal inference should be modified along the way or abandoned." When faced with tensions between the demands of science and "mere relevance" (in John Gerring’s phrase), political scientists tend to bow before the demands of method rather than accede to the importance of the question itself. Why? One reason, as Emile Durkheim famously argued, is that the division of labor is a fundamental fact of modern life because it is an efficient way to accomplish a variety of complex tasks. This growing specialization advances science through deeper investigations focused on increasingly narrow questions. As the discipline sought to become more scientific, in part to better address society's ills, it became less practically relevant. Such progress, however, comes at the cost **of isolating various specialties** from one another and from society as a whole. Friedrich Nietzsche elaborated: "A specialist in science gets to resemble nothing so much as a factory workman who spends his whole life in turning one particular screw or handle on a certain instrument or machine, at which occupation he acquires the most consummate skill." The result is a **hyperfragmentation of knowledge** that now makes it difficult for even scholars in different disciplines to understand one another, much less policy makers and the public. We have become those Nietzschean factory workers, hammering away on our particular parts, while our factories as a whole produce less and less of use to society. Another of the hallmarks of professionalism is "corporateness," which Samuel Huntington defined as "a sense of organic unity and consciousness of themselves as a group apart from laymen." Universities, like most other complex organizations, seek autonomy, reduction of uncertainty, and more resources. When those goals conflict, organizations almost always prefer autonomy. The desire to remain independent — above politics and the policy fray — reinforces irrelevance. Organizational interest also encourages scholars to separate themselves from nonspecialists by using jargon and other modes of discourse that are **incomprehensible to the public**. Sophisticated social-science methods, often accompanied by abstruse jargon, **offer an ideal barrier to entry for the nonprofessional** because they take considerable investment in time and effort to learn. Speaking within the guild helps make the university more distinct from, and hence independent of, the rest of society. One does not have to be as cynical as George Bernard Shaw, who quipped that "all professions are conspiracies against the laity," to believe that the social-scientific withdrawal from relevance is fostered by disciplinary self-interest. The key mechanism through which social science has become homogenous, and often less concerned with issues of broader concern, is peer review. The former American Political Science Review editor Lee Sigelman assembled data showing that the policy relevance of articles published in the APSR declined precipitously after peer review was introduced. He lamented that, "by the early 1960s, prescription had almost entirely vanished from the Review. If ‘speaking truth to power’ and contributing directly to public dialogue about the merits and demerits of various courses of action were still numbered among the functions of the profession, one would not have known it from leafing through its leading journal." I am not arguing that quantitative scholarship is by definition irrelevant. And yet, the increasing tendency to equate rigor with particular techniques **imposes real costs on the rest of society** as well as on the discipline. As a society, we run into trouble when we lack policy-relevant academic perspectives. Indeed, there are instances — the war in Vietnam, the recent Iraq War — in which, had the majority consensus of scholars influenced policy, the country’s national interest would have been **better served.** Social science has a role to play in the most **important policy debates** regardless of whether it happens to use the most scientific methodology. Greater attention to **policy relevance** also produces better scholarship. For one thing, it leads to more realistic theorizing. It also helps social **scientists focus on things that human agency can change**, which ensures greater variation in variables, and in turn makes it easier to understand their relationships. A deeper and more regular engagement between the ivory tower and the Beltway will be mutually beneficial for both. Greater relevance is also in our discipline’s interest, as even the most rigorous social science will ultimately be judged by what it tells us about things that affect the lives of large numbers of people. An article in Science in the late 1960s cautioned that "to the extent that the research community disdains work on major national missions or behaves self-servingly in mission-oriented work, anti-intellectualism will increase its influence on the fate of American science." More recently, congressional reservations about National Science Foundation funding for political science highlighted the direct costs to the field for not being able to justify itself in terms of broader societal impact. Last but not least, we should recognize political science’s ethical obligation to address problems of concern to the rest of society. Harvard’s Robert Putnam stated this eloquently in his 2002 American Political Science Association presidential address: "I believe that attending to the concerns of our fellow citizens is not just an optional add-on for the profession of political science, but an obligation as fundamental as our pursuit of scientific truth." It is well past time for the rest of the discipline to follow his lead.

**Beller’s “derivative communism” is inherently anti-communist. A better blockchain is not the answer to racial capitalism- it just changes the *form* of extraction.**

**Galloway 21**

**(Alexander R. Galloway is a writer and computer programmer working on issues in philosophy, technology, and theories of mediation. Professor of Media, Culture, and Communication at New York University, he is author of several books on digital media and critical theory, including The Interface Effect (Polity, 2012). 3-22-2021, "The World Computer,"** [**http://cultureandcommunication.org/galloway/the-world-computer**](http://cultureandcommunication.org/galloway/the-world-computer)**, JKS)**

I'm intrigued by Beller's proposal that there might be “communist algorithms" and "communist derivatives” (193). Yet the two ought to be differentiated. An algorithm is merely a step by step process, a recipe to follow. **But a derivative**, defined as a form of financial speculation designed to manage risk, **seems inherently anti-communist** in the sense that it works to eliminate socio-political uncertainty. The political is the condition in which one does not know how the future will unfold. In other words I'm not convinced by Beller's proposal for “revolutionary finance,” a proposal taken up more fully at the end of the book. Beller cites the Economic Space Agency (ECSA) and recent attempts to develop crypto currencies. A number of theorists and computer scientists are also wrapped up in this movement, including Brian Massumi, the Deleuzian who recently published 99 Theses on the Revaluation of Value: A Postcapitalist Manifesto (which I discussed previously).

For Beller, the prospect of revolutionary finance is part of an historical development toward the decentralization of authority:

"Bitcoin...[is] part of an insurrectionary history of the decentralization of authority that includes the French Revolution, decolonization, suffrage, 8 mm film, the portapak, the cheap digital camera, and the easy access to publication on the World Wide Web" (243).

Beller thinks that the redesign of economic media has something to offer social struggle. Still, he is nothing like a Bitcoin "maximalist," those staking it all on a technical miracle. Bitcoin “is not the revolution--far from it” (250), as Beller unambiguously puts it. Yet I suspect there is nothing inherently insurrectionary about decentralization--if by "insurrectionary" Beller means politically progressive--decentralization merely marking a shift in the architectonics of power that might favor reactionary tendencies as much as progressive ones. My own contribution to this debate as been around the question of "protocol," a network design style that is both decentralized and distributed, if not also collapsing more and more into centralization with each passing day. Is there a toxic form of money and a non-toxic form of money, our job being merely to distinguish between the two? **Beller's book hinges on a political discrimination, where the "good" money is elevated over the bad. Yet if Marx bequeathed anything to us, it was the notion that the money-form itself is toxic.** Money is extractive abstraction in hyperbolic form. **The solution is not better money built on the blockchain**. The solution is the suspension of the infrastructure of extractive abstraction. Indeed blockchain is an ecological abomination if not also a socio-political one; these machines should be nuked forthwith.

**There is no inherent logic of capital that *requires* race to be the defining feature. They can’t just win that capitalism has racist effects; they must prove that race is *necessary* for capitalism entirely.**

**Go 20**

**(Julian Go is a professor of sociology at the University of Chicago. His most recent books include Postcolonial Thought and Social Theory and Global Historical Sociology (coedited with George Lawson). 12-24-2020, "Three Tensions in the Theory of Racial Capitalism," SAGE Journals, Sociological Theory,** [**https://journals.sagepub.com/doi/full/10.1177/0735275120979822**](https://journals.sagepub.com/doi/full/10.1177/0735275120979822)**, JKS)**

So what is the answer? Again, it helps differentiate between a theory of capital and a theory of capitalism. A theory of capitalism might demonstrate that race has been historically necessary for capitalist accumulation by reference to empirical reality: historically, capitalism and race have always been intertwined. But the claim that race is a logical necessity to capitalism would have to derive from a theory of capital, not from empirics alone. One would have to deduce, from the categories of Marx’s theory, the necessity of racism or racial differentiation in society. On this score, **the arguments for the logical necessity of capitalism’s entanglements with race fall short**. Consider the argument that racism is necessary for capitalism because capitalism requires racist ideology to divide the working class. This is a functionalist argument that is not functionalist enough, for it effaces the logical possibility of functional substitution. We may find that racism has historically always functioned to divide the working class, but in theory other “isms” could serve the same function. There is nothing inherent to the logic of capital that requires race to be the ideology of division (Lebowitz 2006:39).10 Why not ethnicity? Why not sexuality? Consider Fraser’s argument that expropriation is intrinsic to capitalism and that racial differentiation must be too. It is plausible and indeed persuasive to claim that expropriation is necessary for capitalism, but it is less persuasive to claim that racial difference is logically necessary for expropriation. Gender could easily serve as the main axis of dependent classification (and, to feminist-Marxist thought, it has served that function), as could ethnicity, religion, sexuality, or citizenship. Fraser would have to show that expropriation, and hence capitalism, requires a racial classification as opposed to other social categories. This is a task left unfulfilled. A different and possibly more productive route would be to reframe the issue as one of social difference rather than race. Is racism necessary for capitalism? There are good reasons, as just mentioned, to think not. But is social difference of various types (from race to gender to ethnicity) necessary for capitalism?12 This is more demonstrable, both empirically (by reference to actually existing capitalism) and theoretically (by reference to the logic of capital accumulation). For example, Fraser’s argument about expropriation could be reformulated in the following manner: expropriation is logically necessary for exploitation, which is in turn necessary for capital accumulation, and expropriation requires differentiation among workers. This differentiation could be along racial lines, or it could be along other lines such as gender, but differentiation there must be. Note that this argument logically insinuates a racial component but remains abstract enough to account for other possible identities across different capitalist formations. It can account for racialized slave labor in the eighteenth-century transatlantic world (where “race” was a key axis of differentiation), twentieth-century Russia (where ethnicity or religion might be the important axis), or gender across all these formations.

**Racial capitalism cannot explain the global nature of capitalism, which undercuts its explanatory power.**

**Go 20**

**(Julian Go is a professor of sociology at the University of Chicago. His most recent books include Postcolonial Thought and Social Theory and Global Historical Sociology (coedited with George Lawson). 12-24-2020, "Three Tensions in the Theory of Racial Capitalism," SAGE Journals, Sociological Theory,** [**https://journals.sagepub.com/doi/full/10.1177/0735275120979822**](https://journals.sagepub.com/doi/full/10.1177/0735275120979822)**, JKS)**

Yet this scaling upward of capitalism to a global level brings its own complications. It carries the danger of what Bourdieu and Wacquant (1999) called “the cunning of imperialist [racialist] reason”: an analytic operation by which U.S.-centered scholars impose presumably U.S.-centric classifications (in this case, “race”) onto the rest of the world, thereby imposing racial classifications into contexts **where they might not be operative.** We would be obliged, for instance, to impose racial classifications onto Latin American contexts such as Brazil, where the salience of racial classifications is debatable (Loveman 1999; Wimmer 2015). In short, if we are to insist on the global character of racial capitalism, we must assume that analysts’ racial classifications are global as well. They may very well be, but racial capitalism’s founding texts, and more recent discussions, have not sufficiently problematized this tension.2 Can this tension be resolved? One way to do so is to raise the possibility that the racial capitalism concept works best for groups that have been undoubtedly racialized, such as members of the African diaspora in North America.3 Racial capitalism would thus refer mainly to the black ex-slave population, which has suffered some of the clearest and most virulent forms of racism. This might explain why the literature on racial capitalism has focused on African Americans and transatlantic slavery rather than other groups elsewhere in the world. **Yet this seeming resolution would significantly reduce the scope of the racial capitalism concept. Racial capitalism would no longer depict a global system**. Perhaps the best resolution is one that arrives through more reflexive research. We can explore how “race” is connected to capitalism in diverse sites and across historical periods, but we must be more conscious about whether we are referring to analysts’ definition of race or a category of practice. Put simply, we can arrive at a resolution only through careful research that more clearly defines “race.”

**they can't weigh**

**Capitalism is sustainable and self-correcting---alternatives are a false diagnosis and the wrong solution.**

Allison **Schrager 20**, an economist and senior fellow at the Manhattan Institute, 1/15/2020, "Why Socialism Won’t Work," https://foreignpolicy.com/2020/01/15/socialism-wont-work-capitalism-still-best/, Marsh

Capitalism is **still** the best way to handle risk and **boost innovation** and **productivity**.

With increasingly ubiquitous iPhones, internet, central air conditioning, flat-screen TVs, and indoor plumbing, few in the developed world would want to go back to life 100, 30, or even 10 years ago. Indeed, around the **world**, the last two centuries have brought **vast improvements** in material living standards; **billions** of people have been **lifted from poverty**, and **life expectancy** across income levels has broadly risen. Most of that progress came from **capitalist economies**.

Yet those **economies** are not **without their problems**. In the United States and the United Kingdom, the gap between the rich and poor has become intolerably large as business owners and highly educated workers in urban areas have become richer while workers’ wages in rural areas have stagnated. In most rich countries, more trade has brought a bigger, better variety of goods, but it has also displaced many jobs.

With social instability in the form of mass protests, Brexit, the rise of populism, and deep polarization knocking at the capitalist economies’ doors, much of the progress of the last several decades is in peril. For some pundits and policymakers, the solution is clear: **socialism**, which tends to be cited as a method for addressing **everything** from inequality and injustice to climate change.

Yet the very ills that **socialists identify** are best addressed through **innovation**, **productivity** gains, and better **rationing** of risk. And capitalism is still **far and away** the best, if not only, way to generate those outcomes.

Today’s socialism is difficult to define. Traditionally, the term meant total state ownership of capital, as in the Soviet Union, North Korea, or Maoist China. Nowadays, most people don’t take such an extreme view. In Europe, social democracy means the nationalization of many industries and very generous welfare states. And today’s rising socialists are rebranding the idea to mean an economic system that delivers all the best parts of capitalism (growth and rising living standards) without the bad (inequality, economic cycles).

But no perfect economic system exists; there are always trade-offs—in the most extreme form between total state ownership of capital and unfettered markets without any regulation or welfare state. Today, few would opt for either pole; what modern socialists and capitalists really disagree on is the right level of government intervention.

Modern socialists want more, but not complete, state ownership. They’d like to nationalize certain industries. In the United States, that’s health care—a plan supported by Democratic presidential candidates Elizabeth Warren (who does not call herself a socialist) and Bernie Sanders (who wears the label proudly). In the United Kingdom, Labour Party leader Jeremy Corbyn, who was trounced at the polls in mid-December, has set his sights on a longer list of industries, including the water, energy, and internet providers.

Other items on the socialist wish list may include allowing the government to be the primary investor in the economy through massive infrastructure projects that aim to replace fossil fuels with renewables, as Green New Deal socialists have proposed. They’ve also floated plans that would make the government the employer of a majority of Americans by offering guaranteed well-paid jobs that people can’t be fired from. And then there are more limited proposals, including installing more workers on the boards of private companies and instituting national rent controls and high minimum wages.

For their part, modern capitalists want some, **but less**, state intervention. They are skeptical of nationalization and price controls; they argue that today’s economic problems are **best addressed** by harnessing private enterprise. In the United States, they’ve argued for more regulation and progressive taxation to help ease inequality, incentives to encourage private firms to use less carbon, and a more robust welfare state through tax credits. Over the past 15 years, meanwhile, capitalist Europeans have instituted reforms to improve labor market flexibility by making it easier to hire and fire people, and there have been attempts to reduce the size of pensions.

No economic system is perfect, and the **exact** right **balance** between markets and the state **may never be found**. But there are good reasons to believe that keeping capital in the hands of the **private sector**, and empowering its owners to make decisions **in the pursuit of profit**, is the **best** we’ve got.

One reason to trust markets is that they are better at **setting prices** than people. If you set prices **too high**, many a socialist government has found, citizens will be **needlessly deprived** of goods. Set them **too low**, and there will be **excessive** demand and **ensuing shortages**. This is true **for all goods**, including health care and labor. And there is **little reason** to believe that the **next batch of socialists** in **Washington** or London would be **any better** at setting prices than their predecessors. In fact, government-run health care systems in Canada and European countries are plagued by long wait times. A 2018 Fraser Institute study cites a median wait time of 19.8 weeks to see a specialist physician in Canada. Socialists may argue that is a small price to pay for universal access, but a market-based approach can deliver both **coverage** and **responsive service**. A full government takeover isn’t the only option, nor is it the best one.

Beyond that, markets are also good at **rationing risk**. Fundamentally, socialists would like to **reduce** risk—protect workers from any personal or economywide **shock**. That is a noble goal, and some reduction through **better functioning safety nets is desirable**. But getting rid of all **uncertainty**—as state ownership of most industries would imply—is a **bad idea**. Risk is what **fuels** growth. People who take more chances tend to reap **bigger rewards**; that’s why the top nine names on the Forbes 400 list of the richest Americans are not heirs to family dynasties **but are self-made entrepreneurs** who took a leap to **build new products** and created **many jobs** in the process.

Some leftist economists like Mariana Mazzucato argue that governments might be able to step in and become **laboratories for innovation**. But that would be a **historical anomaly**; socialist-leaning governments have typically been **less innovative than others**. After all, bureaucrats and worker-corporate boards have **little incentive** to upset the status quo or **compete** to build a better widget. And even when government programs have spurred innovation—as in the case of the internet—**it took the private sector** to recognize the value and create a market.

And that brings us to a third reason to believe in markets: **productivity**. Some economists, such as Robert Gordon, have looked to today’s economic problems and suggested that productivity growth—the engine that fueled so much of the progress of the last several decades—is over. In this telling, the resources, products, and systems that underpin the world’s economy are all optimized, and little further progress is possible.

But that is hard to square with reality. **Innovation** helps economies **do more with fewer resources**—increasingly critical to addressing **climate change**, for example—which is a form of **productivity growth**. And likewise, many of the **products and technologies** people rely on every day did not exist a few years ago. These goods make **inaccessible services** more available and are changing the nature of work, often **for the better**. Such gains are made possible by **capitalist systems** that encourage **invention and growing** the pie, not by socialist systems that are more concerned with how the existing **pie is cut**. It is **far too soon**, in other words, to write off productivity.

Here, it is worth considering the lessons of a previous productivity boom: the Industrial Revolution. As the economist Joel Mokyr has shown, it took new innovations like the steam engine more than 100 years to appear in productivity estimates. The same could be happening today with smartphones and the internet. Meanwhile, even as that upheaval transformed the human experience, creating a more comfortable existence for most everyone, it was also messy and disruptive. The early part of that innovative cycle—like others since—displaced existing workers while the gains flowed to the owners of capital first, causing social instability.

This time around, the **effects** may end up **being less wrenching**: The **divisions** between **owners** of capital and **workers** are not as clear as they used to be. More Americans **than ever** own stock through their workplace retirement accounts. Stock ownership is on the rise in many non-U.S. **capitalist economies**, too. And several other countries, such as Australia and the United Kingdom, also offer retirement accounts, making their citizens shareholders as well. Unlike 200 years ago, workers’ interests are **already** more aligned with those of management.

**Space Commercialization drives Tech Innovation in the Status Quo – it provides a unique impetus – prefer specify**

**Hampson 17** Joshua Hampson 1-25-2017 “The Future of Space Commercialization” <https://republicans-science.house.gov/sites/republicans.science.house.gov/files/documents/TheFutureofSpaceCommercializationFinal.pdf> (Security Studies Fellow at the Niskanen Center)//Elmer

The size of the **space economy** is **far larger** than many may think. In 2015 alone, the global market amounted to $323 billion. **Commercial** infrastructure and **systems** **accounted for 76 percent** of that 9 total, with satellite television the largest subsection at $95 billion. The global space launch market’s 10 11 share of that total came in at $6 billion dollars. It can be hard to disaggregate how space benefits 12 particular national economies, but in 2009 (the last available report), the Federal Aviation Administration (FAA) estimated that commercial space transportation and enabled industries generated $208.3 billion in economic activity in the United States alone. Space is not just about 13 satellite television and global transportation; while not commercial, GPS satellites also underpin personal navigation, such as smartphone GPS use, and timing data used for Internet coordination.14 Without that data, there could be problems for a range of Internet and cloud-based services.15 There is also room for growth. The FAA has noted that while the commercial launch sector has not grown dramatically in the last decade, there are indications that there is latent demand. This 16 demand may catalyze an increase in launches and growth of the wider space economy in the next decade. The Satellite Industry Association’s 2015 report highlighted that their section of the space economy outgrew both the American and global economies. The FAA anticipates that growth to 17 continue, with expectations that small payload launch will be a particular industry driver.18 In the future, **emerging space industries** may contribute even more the American economy. Space tourism and resource recovery—e.g., mining on planets, moons , and asteroids—in particular may become large parts of that industry. Of course, their viability rests on a range of factors, including costs, future regulation, international problems, and assumptions about technological development. However, there is increasing optimism in these areas of economic production. But the space economy is not just about what happens in orbit, or how that alters life on the ground. The growth of this economy can also **contribute to** **new innovations across all walks of life.** Technological Innovation Innovation is generally hard to predict; some new technologies seem to come out of nowhere and others only take off when paired with a new application. It is difficult to predict the future, but it is reasonable to expect that **a growing space economy would open opportunities for technological and organizational innovation**. In terms of technology, **the difficult environment** of outer space helps **incentivize progress along the margins**. Because each object launched into orbit costs a significant amount of money—at the moment between $27,000 and $43,000 per pound, though that will likely drop in the future —each 19 reduction in payload size saves money or means more can be launched. At the same time, the ability to fit more capability into a smaller satellite opens outer space to actors that previously were priced out of the market. This is one of the reasons why **small, affordable satellites** are increasingly pursued by companies or organizations that cannot afford to launch larger traditional satellites. These small 20 satellites also provide non-traditional launchers, such as engineering students or prototypers, the opportunity to learn about satellite production and test new technologies before working on a full-sized satellite. **That expansion of developers, experimenters, and testers cannot but help increase innovation opportunities. Technological developments from outer space have been applied to terrestrial life since the earliest days of space exploration. The National Aeronautics and Space Administration (NASA) maintains a website that lists technologies that have spun off from such research projects. Lightweight 21 nanotubes, useful in protecting astronauts during space exploration, are now being tested for applications in emergency response gear and electrical insulation. The need for certainty about the resiliency of materials used in space led to the development of an analytics tool useful across a range of industries. Temper foam, the material used in memory-foam pillows, was developed for NASA for seat covers. As more companies pursue their own space goals, more innovations will likely come from the commercial sector. Outer space is not just a catalyst for technological development. Satellite constellations and their unique line-of-sight vantage point can provide new perspectives to old industries. Deploying satellites into low-Earth orbit, as Facebook wants to do, can connect large, previously-unreached swathes of 22 humanity to the Internet. Remote sensing technology could change how whole industries operate, such as crop monitoring, herd management, crisis response, and land evaluation, among others. 23 While satellites cannot provide all essential information for some of these industries, they can fill in some useful gaps and work as part of a wider system of tools. Space infrastructure, in helping to change how people connect and perceive Earth, could help spark innovations on the ground as well. These innovations, changes to global networks, and new opportunities could lead to wider economic growth**.

**Neoliberal globalization reduce the frequency and severity of wars by a factor of ten.**

**Mooney 14** – Loren, Stanford Graduate School of Business, summarizing Matthew O. Jackson, the William D. Eberle Professor of Economics at Stanford, and earned his PhD in economics from Stanford GSB in 1988. (“Matthew O. Jackson: Can Trade Prevent War?” May 28, 2014https://www.gsb.stanford.edu/insights/matthew-o-jackson-can-trade-prevent-war)

While there is considerable existing research on the effects of trade and war, much of it has looked at bilateral relationships. This model focuses on **multilateral interactions** and considers various incentives for countries to attack, form alliances with, and trade with one another. In an attempt to understand what's necessary to achieve a stable network with no incentive for war, Jackson and Nei first explored an alliance scenario based solely on military defense considerations, excluding trade. "The fundamental difficulty we find is that **alliances are costly to maintain if there's no economic incentive**," says Jackson. So networks remain relatively sparse, a condition in which even a few shifting allegiances leaves some countries vulnerable to attack. "**Stability is not just a little bit elusive; it's very elusive**."

Economic trade, however, makes a **significant difference**. "Once you bring in trade, you see network structures densify," he says. Nations form a web of trading alliances, which creates **financial incentive** not only to **keep peace** with trading partners, but also to **protect them** from being attacked so as not to disrupt trade. "In the context of the alliances we have analyzed, trade motives are essential to **avoiding wars and sustaining stable networks**," the authors wrote in their paper, Networks of Military Alliances, Wars, and International Trade.

Their findings coincide with two major global trends since World War II: From 1950 to 2000, the incidence of interstate war has **decreased nearly tenfold** compared with the period from 1850 to 1949. At the same time, since 1950 international trade networks have increased nearly fourfold, becoming significantly more dense. "In the period before World War II, it was hard to find a stable set of alliances," says Jackson. The probability of a lasting alliance was about 60%. "You have almost a coin-flip chance that the alliance won't still be there in five years," he says. In Europe in the 1870s, for example, German chancellor Otto von Bismarck sought peace with "balance of power" diplomacy, which crumbled leading up to World War I. "Then in the past 50 years or so, there's been a surprising global stability." The impact of economic interdependence is especially apparent in Europe, Jackson says, where the Eurozone has promoted not only peace and increased trade among nations, but also labor mobility.

Very costly wars still occur, of course, but Jackson notes that **the most war-torn places** in recent history have tended to be those with **fewer global trade alliances**. For example, the Second Congo War from 1998 to 2003 and beyond, which killed more than **four million people** and is the deadliest war since World War II, involved eight African nations with relatively **few trade ties**. "Then look at the Kuwait situation," says Jackson, referring to U.S. intervention in the first Gulf War to protect oil supplies. "Economic interest drives a lot of what goes on in terms of where nations are willing to exercise military strength."

There are other real-world factors that have no doubt influenced war and trade trends since World War II, among them the proliferation of nuclear weapons — "Changing military technology can help maintain stable arrangements," says Jackson — the Cold War, an increase in worldwide wealth levels, and the introduction of container shipping in the 1960s, which has helped facilitate low-cost, long-range trade.

Still, Jackson and Nei's theoretical model suggests that **trade alliances play a critical role.** And in fact **economic allies** may be the most worth striving for in developing areas. "Maybe wars like the Second Congo War **won't be occurring in the future if there's more trade** with African nations," says Jackson. "Economic interests can really help us have a more peaceful world than we already have."

**Tech innovation undergirded by profit motives are driving the Second Machine Age, which dematerializes capitalism and makes growth a sustainable necessity**

**McAfee, 19**—cofounder and codirector of the MIT Initiative on the Digital Economy at the MIT Sloan School of Management, former professor at Harvard Business School and fellow at Harvard’s Berkman Center for Internet and Society (Andrew, “Looking Ahead: The World Cleanses Itself This Way,” *More from Less: The Surprising Story of How We Learned to Prosper Using Fewer Resources—and What Happens Next*, Chapter 14, pg 278-292, Kindle, dml)

**The decreases in resource use, pollution, and other exploitations of the earth** cataloged in the preceding chapters **are great news. But are they going to last? It could be that we're just living in a pleasant interlude between the Industrial Era and another** rapacious **period during which we massively increase our footprint on our planet and** eventually **cause a giant Malthusian crash**.

It could be, but **I don't think so**. Instead, I think **we're going to take better care of our planet from now on**. I'm confident that **the Second Machine Age will mark the time in our history when we started to progressively and permanently tread more lightly on the earth, taking less from it and generally caring for it better, even as we humans continue to become more numerous and prosperous**. The work of Paul Romer, who shared the 2018 Nobel Prize in economics, is one of the sources of this confidence.

Growth Mindset

Romer's largest contribution to economics was to show that it's best not to think of new technologies as something that companies buy and bring in from the outside, but instead as something they create themselves (the title of his most famous paper, published in 1990, is "Endogenous Technological Change"). These **technologies are like designs or recipes**; as Romer put it, they’re "**the instructions that we follow for combining raw materials**." This is close to the definitions of technology presented in chapter 7.

**Why do companies invent and improve technologies?** Simply, **to generate profits. They come up with instructions, recipes, and blueprints that will let them grow revenues or shrink costs**. As we saw repeatedly in chapter 7, **capitalism provides ample incentive for this kind of tech progress**.

So far, all this seems like a pretty standard argument for how the first two horsemen work together. Romer's brilliance was to highlight the importance of two key attributes of the **technological ideas** companies come up with as they pursue profits. The first is that **they're nonrival**, meaning that **they can be used by more than one person or company at a time, and that they don't get used up**. This is obviously not the case for most resources made out of atoms—I can't also use the pound of steel that you've just incorporated into the engine of a car—but it is the case for ideas and instructions. The Pythagorean theorem, a design for a steam engine, and a recipe for delicious chocolate chip cookies aren't ever going to get "used up" no matter how much they're used.

The second important aspect of corporate technologies is that **they're partially excludable**. This means that companies can kind of prevent others from using them. They do this by keeping the technologies secret (such as the exact recipe for Coca-Cola), filing for patents and other intellectual-property protection, and so on. However, none of these measures is perfect (hence the words partially and kind of). Trade secrets leak. Patents expire, and even before they expire, they must describe the invention they're claiming and so let others study it.

**Partial excludability** is a beautiful thing. It **provides strong incentives for companies to create useful, profit-enhancing new technologies** that they alone can benefit from for a time, **yet it also ensures that the new techs will eventually "spill over"—that with time they’ll diffuse and get adopted by more and more companies**, even if that's not what their originators want.

Romer equated tech progress to the production by companies of nonrivalrous, partially excludable ideas and showed that **these ideas cause an economy to grow**. What's more, he also demonstrated that **this idea-fueled growth doesn't have to slow down with time. It's not constrained by the size of the labor force, the amount of natural resources, or other such factors**. Instead, **economic growth is limited only by the idea-generating capacity of the people within a market**. Romer called this capacity "human capital" and said at the end of his 1990 paper, "The most interesting positive implication of the model is that an economy with a larger total stock of human capital will experience faster growth."

This notion, which has come to be called **"increasing returns to scale," is as powerful as it is counterintuitive. Most formal models of economic growth**, as well as the informal mental ones most of us walk around with, **feature decreasing returns—growth slows down as the overall economy gets bigger. This makes intuitive sense**; it just feels like it would be easier to experience 5 percent growth in a $1 billion economy than a $1 trillion one. **But** Romer showed that as long **as that economy continued to add to its human capital—the overall ability of its people to come up with new technologies and put them to use—it could actually grow faster even as it grew bigger. This is because the stock of useful, nonrivalrous, nonexcludable ideas would keep growing**. As Romer convincingly showed, economies run and grow on ideas.

The Machinery of Prosperity

Romer's ideas should leave us optimistic about the planetary benefits of digital tools—hardware, software, and networks—for three main reasons. First, **countless examples show us how good** these tools are at fulfilling the central role of **technology**, which **is** to provide "instructions that we follow **for combining raw materials**." **Since raw materials cost money, profit-maximizing companies are particularly keen to find ways to use fewer of them**. So they use digital tools to come up with beer cans that use less aluminum, car engines that use less steel and less gas, mapping software that removes the need for paper atlases, and so on and so on. **None of this is done solely for the good of the earth—it's done for the pursuit of profit that's at the heart of capitalism—yet it benefits the planet by**, as we've seen, **causing us to take less from it**.

Digital tools are technologies for creating technologies, the most prolific and versatile ones we've ever come up with. They're machines for coming up with ideas. Lots of them. **The same piece of computer-aided design software can be used to create a thinner aluminum can or a lighter and more fuel-efficient engine. A drone can be used to scan farmland** to see if more irrigation is needed, **or to substitute for a helicopter** when filming a movie. **A smartphone can be used** to read the news, listen to music, and pay for things, all **without consuming a single extra molecule**.

In the Second Machine Age, **the global stock of digital tools is increasing much more quickly than ever before. It's being used in countless ways by profit-hungry companies to combine raw materials in ways that use fewer of them**. In advanced economies such as America's, **the cumulative impact of this combination of capitalism and tech progress is clear: absolute dematerialization of the economy and society, and thus a smaller footprint on our planet**.

The second way Romer's ideas about technology and growth are showing up at present is via decreased excludability. **Pervasive digital tools are making it much easier for good designs and recipes to spread around the world**. While this is often not what a company wants—it wants to exclude others from its great cost-saving idea— excludability is not as easy as it used to be.

This isn't because of weaker patent protection, but instead because of stronger digital tools. **Once one company shows what's possible, others use hardware, software, and networks to catch up to the leader. Even if they can't copy exactly** because of intellectual-property restrictions, **they can use digital tools to explore other means to the same end. So, many farmers learn to get higher yields while using less water and fertilizer, even though they combine these raw materials in different ways**. Steve Jobs would certainly have preferred for Apple to be the only provider of smartphones after it developed the iPhone, but he couldn't maintain the monopoly no matter how many patents and lawsuits he filed. Other companies found ways to combine processors, memory, sensors, a touch screen, and software into phones that satisfied billions of customers around the world.

The operating system that powers most non-Apple smartphones is Android, which is both free to use and freely modifiable. Google's parent company, Alphabet, developed and released Android without even trying to make it excludable; the explicit goal was to make it as widely imitable as possible. This is an example of the broad trend across digital industries of giving away valuable technologies for free.

The Linux operating system, of which Android is a descendant, is probably the best-known example of free and open-source software, but there are many others. The online software repository GitHub maintains that it's "the largest open source community in the world" and hosts millions of projects. The Arduino community does something similar for electronic hardware, and the Instructables website contains detailed instructions for making equipment ranging from air-particle counters to machine tools, all with no intellectual-property protection. Contributors to efforts such as these have a range of motivations (Alphabet's goals with Android were far from purely altruistic—among other things, the parent of Google wanted to achieve a quantum leap in mobile phone users around the world, who would avail themselves of Google Search and services such as YouTube), but they're all part of the trend of technology without excludability, which is great news for growth.

As we saw in chapter 10, **smartphone use and access to the Internet are increasing quickly across the planet. This means that people no longer need to be near a decent library or school to gain knowledge and improve their abilities. Globally, people are taking advantage of the skill-building opportunities of new technologies**. This is the third reason that the spread of digital tools should make us optimistic about future growth: **these tools are helping human capital grow quickly**.

The free Duolingo app, for example, is now the world's most popular way to learn a second language. Of the nearly 15 billion Wikipedia page views during July of 2018, half were in languages other than English. Google's chief economist, Hal Varian, points out that hundreds of millions of how-to videos are viewed every day on YouTube, saying, "We never had a technology before that could educate such a broad group of people anytime on an as-needed basis for free."

Romer's work leaves me hopeful because it shows that **it's our ability to build human capital, rather than chop down forests, dig mines, or burn fossil fuels that drives growth and prosperity**. His model of how economies grow also reinforces how well capitalism and tech progress work together, which is a central point of this book. **The surest way to boost profits is to cut costs, and modern technologies, especially digital ones, offer unlimited ways to combine and recombine materials—to swap, slim, optimize, and evaporate—in cost-reducing ways. There's no reason to expect that** the two horsemen of **capitalism and tech progress will stop** riding together **anytime soon. Quite the contrary**. Romer's insights reveal that **they're likely to gallop faster and farther as economies grow**.

Our Brighter, Lighter Future

**The world still has billions of desperately poor people, but they won't remain that way. All available evidence strongly suggests that most will become much wealthier in the years and decades ahead. As they earn more and consume more, what will be the impact on the planet?**

The **history** and economics of the Industrial Era **lead to pessimism** on this important question. **Resource use increased in lockstep with economic growth throughout** the two **centuries** between James Watt's demonstration of his steam engine and the first Earth Day. **Malthus and Jevons seemed to be right, and it was just a question of when, not if, we'd run up against the hard planetary limits to growth.**

**But** in America and other rich countries **something strange, unexpected, and wonderful happened: we started getting more from less. We decoupled population and economic growth from resource consumption, pollution, and other environmental harms. Malthus's and Jevons's ideas gave way** to Romer's, and the world will never be the same.

This means that **instead of worrying about the world's poor becoming richer, we should instead be helping them upgrade economically as much and as quickly as possible**. Not only is it the morally correct thing to do, **it's** also **the smart move for our planet. As today’s poor countries get richer, their institutions will improve and most will eventually go through** what Ricardo Hausmann calls "**the capitalist makeover of production**." **This makeover doesn't enslave people, nor does it befoul the earth**.

**As today’s poor get richer, they'll consume more, but they'll also consume much differently** from earlier generations. **They won't read physical newspapers and magazines. They'll get a great deal of their power from renewables and** (one hopes) **nuclear because these energy sources will be the cheapest**. They’ll live in cities, as we saw in chapter 12; in fact, they already are. **They'll be less likely to own cars** because a variety of transportation options will be only a few taps away. Most important, **they'll come up with ideas that keep the growth going, and that benefit both humanity and the planet we live on**.

Predicting exactly how technological progress will unfold is much like predicting the weather: feasible in the short term, but impossible over a longer time. **Great uncertainty and complexity prevent precise forecasts about**, for example, the **computing devices** we’ll be using thirty years from now **or the dominant types of a**rtificial **i**ntelligence in 2050 and beyond.

**But** even though we can't predict the weather long term, **we can accurately forecast** the climate. We know how much warmer and sunnier it will be on average in August than in January, for example, and we know that global average temperatures will rise as we keep adding greenhouse gases to the atmosphere. Similarly, we can predict **the "climate" of future technological progress by starting from the knowledge that it will be heavily applied in the areas where it can affect capitalism the most. As we've seen over and over, tech progress supplies opportunities to trim costs (and improve performance) via dematerialization, and capitalism provides the motive to do so**.

As a result, **the Second Enlightenment** will continue as we move deeper into the twenty-first century. I'm confident that it **will accelerate as digital technologies continue to improve and multiply and global competition continues to increase**. We’ll see some of the most striking examples of slim, swap, evaporate, and optimize in exactly the places where the opportunities are biggest. Here are a few broad predictions, spanning humanity's biggest industries.

Manufacturing. Complex parts will be made not by the techniques developed during the Industrial Era, but instead by three- dimensional printing. This is already the case for some rocket engines and other extremely expensive items. **As 3-D printing improves and becomes cheaper, it will spread to** automobile engine blocks, manifolds and other complicated arrangements of pipes, airplane struts and wings, and **countless other parts. Because 3-D printing generates virtually no waste and doesn't require massive molds, it accelerates dematerialization**.

**We'll also be building things out of very different materials** from what we're using today. **We're rapidly improving our ability to use machine learning and massive amounts of computing power to screen the huge number of molecules available in the world. Well use this ability to determine which substances would be best for making flexible solar panels, more efficient batteries, and other important equipment. Our search for the right materials to use has so far been slow and laborious. That's about to change**.

**So is our ability to understand nature's proteins, and to generate new ones**. All living things are made out of the large biomolecules known as proteins, as are wondrous materials such as spiders' silk. The cells in our bodies are assembly lines for proteins, but we currently understand little about how these assembly lines work—how they fold a two-dimensional string of amino acids into a complicated 3-D protein. But thanks to **digital tools**, we're learning quickly. In 2018, as part of a contest, the AlphaFold software developed by Google DeepMind correctly guessed the structure of twenty-five out of forty-three proteins it was shown; the second-place finisher guessed correctly three times. DeepMind cofounder Demis Hassabis says, "We [haven't] solved the protein-folding problem, this is just a first step... but we have a good system and we have a ton of ideas we haven't implemented yet." As these good ideas accumulate, they **might** well **let us** make spider-strength materials.

Energy. **One of humanity's most urgent tasks** in the twenty-first century **is to reduce greenhouse gas emissions. Two ways to do this are to become more efficient in using energy and, when generating it, to shift away from carbon-emitting fossil fuels. Digital tools will help greatly with both**.

**Several groups have recently shown that they can combine machine learning and other techniques to increase the energy efficiency of data centers by as much as 30 percent**. This large improvement matters for two reasons. First, **data centers are heavy users of energy**, accounting for about 1 percent of global electricity demand. So efficiencies in these facilities help. Second, and more important, **these gains indicate how much the energy use of all our other complicated infrastructures— everything from electricity grids to chemical plants to steel mills—can be trimmed. All are a great deal less energy efficient than they could be. We have both ample opportunity and ample incentive now to improve them.**

**Both wind and solar power are becoming much cheaper**, so much so that **in many parts of the world they're now the most cost-effective options**, even without government subsidies, for new electrical generators. These energy sources use virtually no resources once they're up and running and generate no greenhouse gases; **they're among the world champions of dematerialization.**

**In the decades to come they might well be joined by nuclear fusion**, the astonishingly powerful process that takes place inside the sun and other stars. Harnessing fusion has been tantalizingly out of reach for more than half a century—the old joke is that it's twenty years away and always will be. A big part of the problem is that it's hard to control the fusion reaction inside any human- made vessel, but **massive improvements in sensors and computing power are boosting hope that fusion power might truly be only a generation away**.

Transportation. **Our current transportation systems are chronically inefficient**. Most vehicles aren't used much of the time, and even when they’re in use, they're not nearly full. Now that we have **technologies** that let us know where every driver, passenger, piece of cargo, and vehicle is at all times, we **can greatly increase the utilization and efficiency of every element of transportation**.

Renting instead of owning transportation is a likely consequence of this shift. Instead of owning cars, which typically sit idle more than 90 percent of the time, more people will choose to access transportation as needed. We're already seeing this with car-hailing companies such as Uber and Lyft. These services are quickly spreading around the world, and expanding to cover more modes of transportation, from motorbikes to bicycles to electric scooters. They're also moving into commercial applications such as long- and short-haul trucking. As this shift continues, **we’ll need fewer tons of steel, aluminum, plastic, gasoline, and other resources to move the world's people and goods around**.

We might also experience less congestion and gridlock as we try to get around. Bikes and scooters take up little space compared to cars, so streets can accommodate many more of them. Technology also gives us the ability to implement many forms of "congestion pricing," which has been shown to reduce gridlock by making car access to busy streets expensive enough that people use other options. The most intriguing future transportation platform of all might be the sky. The same technologies that power today's small drones can be scaled up to build "air taxis" with as many as eight propellers and no pilot. Such contraptions sound like science fiction today, but they might be carrying us around by midcentury.

Agriculture. As we saw in chapter 5, **leading farms have demonstrated an ability to increase their tonnage of output year after year while decreasing their use of inputs such as land, water, and fertilizer. This trend toward optimization will continue thanks to** a set of innovations under the label **precision agriculture**. The precision comes from many sources, including better sensors of plant and animal health, soil quality and moisture, and so on; the ability to deliver fertilizer, pesticides, and water just where they're needed; and machinery that adapts itself to each plant or animal. All these **varieties of precision will combine to allow traditional farms to generate more from less.**

**So will changes to the genomes of plants and animals. DNA modifications will increase disease and drought tolerance, expand where crops can be grown, and allow us to get more of what we want from each crop or herd**. As we saw in chapter 9, **they'll also allow us to take better care of vulnerable populations** such as infants in poor countries **by creating golden rice and other nutrition enhancers. We'll also be able to make much more precise and targeted genetic modifications** thanks to a new crop of gene-editing tools that are large improvements over their more scattershot predecessors. Opposition to genetically modified organisms is fierce in some quarters, but isn't based on reason or science. This opposition will, one hopes, fade.

Throughout human history, **just about all farming has been done in fields. For some crops, this is now changing. Agriculture has moved indoors, where parameters** such as light, humidity, fertilizer, and even the composition of the atmosphere **can be precisely monitored and controlled**. In everything from urban buildings to shipping containers, **crops are now being grown with progressively less labor and fewer material inputs. These completely contained farms will spread and help reduce the planetary footprint of our agriculture**.

These examples aren't intended to be comprehensive, and I don't have precise estimates of how likely each innovation is, or when it's most likely to occur. I offer them only to indicate how broad and exciting are the possibilities offered by the two horsemen of **capitalism and technological progress**, and how they’ll continue to **dematerialize our consumption and let us increase our prosperity while treading more lightly on our planet**.

**No limits to growth---their models ignore key feedback effects.**

**Lynch 16**—President of Strategic Energy and Economic Consulting, Director of Asian Energy and Security at the Center for International Studies at MIT, and a Lecturer at Tufts and Vienna University [Michael, *The “peak oil” scare and the coming oil flood*, p. 63-74]

More recently, there has been a clamor about "peak everything" based on the idea that, well, everything is finite and we 're using it up, so it is "running out." Or at least, production must peak. Or, as one physicist [END OF PAGE 63] points out, eventually human energy production will generate as much heat as the sun does-eventually being 1400 years.

Flat Earth

Colin Campbell, in the famed (well, famous in the IEA's offices) debate at the IEA in 1997, compared resource optimists to the conservative Spanish court that opposed the visionary, Columbus, and has since referred to those, like Adelman and me, who disagreed with him as "flat-earth economists." Albert Bartlett later explained that the term actually meant that economists thought the earth had two dimensions and thus was infinite, containing equivalently infinite resources.

But this description **ignores** two important variables: **capital and knowledge**. Additional investment can often increase the production of renewables like agricultural products and nonrenewables like minerals and oil in the same amount of space, as can **better tech**nology. Neo-Malthusians tend to **ignore this factor** and argue that the rate of technological advance (and greater scientific knowledge) has diminished or disappeared, as described in Chapter 7.

The argument is somewhat specious and relies in part the question of the finiteness of resources, discussed earlier-or a static measure of resources and dynamic view of consumption, as in The Limits to Growth.

HOW LONG?

Perhaps the most important factor that raises skepticism is the fact that at least some exponential alarmists fear the distant future. Any number of pundits have looked at long-term forecasts of economic and/or technological development and characterized them as foolish. We have no flying cars, nuclear power is not too cheap to meter, and no one is eating Soylent Green. On the other hand, most of these **were not serious forecasting efforts**, but rather **off-the-cuff remarks** (or the equivalent), and those making them were not particularly serious about achieving them within a specific time frame. And we do eat Soylent Green already; only we call it tofu and vegemite. (Read the book, it wasn't people.)

NEWTON'S FIRST LAW

The biggest mistakes have come from an apparent source: **extrapolation** of a trend **endlessly**, as if there were no feedback or other variables [END PAGE 64] involved. Jay Forrester, the inventor of Systems Dynamics, which was used in The Limits to Growth model (and which I have used), reportedly once said that **feedback effects** tend to **overwhelm** the initial stimuli, which is probably true in many cases. Yet, many neo-Malthusians and especially peak oil advocates tend to extrapolate a given trend endlessly, assuming no feedback effect whatsoever.

Indeed, the first wave of peak oil advocates explicitly argued that no feedback effect would occur: prices didn't affect production or consumption levels. Technological advances were either unimportant or had ceased and so could not increase the resource base.

An **important element** of the fear of exponential growth is the analysts' choice of **particularly high** growth rates. As Figure 4.1 showed, Ehrlich chose the **highest observed** growth in the 20th century for his calculations, even though it represented the post-World War II **baby boom** and should have been considered **an exception**, not the norm. Similarly, Bartlett, writing in 1998, talks about the growth in oil demand from the 1950s and 1960s at 7 [percent] a year, which causes a doubling of use every decade, 25 which sounds alarming, given the arguments about the difficulty of making a speedy energy transition, until you realize that consumption growth dropped to 3% per year in the 1970s (a doubling time of 24 years), and under **1 [percent] per year** in the 1980s (a doubling period of 75 years), before recovering to 1.5% in the seven years before his talk (48 years).

This emphasizes the lack of feedback mechanism used in these simplistic models and how important they are in the real world.

REAL SCARCITY

Indeed, the subtext of the fear of resource scarcity is that renewable resources have repeatedly been the source of problems. In **Tainter**'s The Collapse of Complex Societies, he talks about resources as causing the fall of a number of (mostly) ancient civilizations; **nearly all** suffered from problems like **lengthy droughts** and **salt buildup** in irrigated farmland. 26

And similar problems continue today, especially if you consider endangered species, from rhinos to tuna. In all cases, these are renewable resources, the very ones that are NOT finite, that are sustainable, that we can rely on for all eternity-in theory. **No lasting shortage** of nonrenewable resources minerals and energy-has occurred **since the advent of the global economy**.

**It's try or die for CCS - only way to stay below 2 degrees but it requires growth and innovation**

**Sognnaes and Peters 20** [Ida Sognnaes is a senior researcher. Glen Peters is a research director] “Carbon Capture and Storage is necessary to keep global warming below 2C,” Cicero Oslo, January 14, 2020, <https://cicero.oslo.no/no/posts/nyheter/carbon-capture-and-storage-is-necessary-to-keep-global-warming-below-2c> TG

Scenarios indicate that Carbon Capture and Storage (CCS) is critical to meet the Paris Agreement’s goal of limiting global warming to ‘well below 2°C’. But, at what scale?

Achieving the Paris Agreement’s goal of limiting global warming to ‘well below 2°C above preindustrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels’ necessitates rapid reductions in greenhouse gas emissions.

There are now hundreds of emission scenarios showing different evolutions of the energy system consistent with the goals of the Paris Agreement. CCS plays a crucial role in nearly all these emission scenarios.

There is a physical reason why CCS is crucial. CO2 emissions have a cumulative effect on the climate, and therefore CO2 emissions [must be net-zero](https://cicero.oslo.no/no/posts/klima/beyond-carbon-budgets)to stop temperatures from increasing further. CCS helps achieve net-zero emissions in two ways:

1. To help reduce direct emissions from the burning of fossil fuels or from industrial processes, and
2. To help create negative emissions,

such as in combination with bioenergy (BECCS), direct air capture, or other technologies to remove CO2 from the atmosphere.

Nearly all emissions scenarios use CCS in both these ways, and sometimes at a [troubling scale](https://science.sciencemag.org/content/354/6309/182).

The following figure highlights this.

CCS is used to help reduce emissions from fossil fuel use, which happens in addition to conventional mitigation, such as consuming less energy, deploying solar, or using electric vehicles, But, most scenarios are not able to get fossil emissions completely to zero, or find it too expensive, and end with ‘residual emissions’ (brown in the figure above).

To get to net-zero emissions, the [residual emissions](https://www.nature.com/articles/s41558-018-0198-6) must be [counteracted](https://cicero.oslo.no/no/posts/nyheter/carbon-capture-and-storage-is-necessary-to-keep-global-warming-below-2c) by [CO2 removal](https://www.mcc-berlin.net/en/research/policy-briefs/negativeemissions.html) to achieve net zero emissions (dark green). Most models do this with afforestation or bioenergy with CCS (BECCS). Non-CO2 greenhouse gas emissions (such as methane) add to the residual emissions (not shown).

Further CO2 removal (light green), are used to bring temperatures down after peaking. The temperature is a maximum when the net emissions reach zero (black line), but then the temperature declines with net negative emissions to bring the temperature down from its peak to safer levels by 2100.