

The Modern Commercialization of Science is a Passel of Ponzi Schemes

Nicholas Mullins Lecture

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My college writing teachers had always warned me that to begin with a title that unceremoniously announced the primary thesis of the paper was a mistake. In an artful text there should always suffuse a little air of mystery as to precisely where an argument would end up; and anyway, prosaic declarative sentences delivered deadpan smacked of high-school compositions written under duress. Metaphor, synecdoche, humor, litotes and all the other conceits of rhetoric were deemed far superior to dishwater prose, if only because they hinted at things not easily rendered literal. Those familiar with my previous books will appreciate just how much I had taken their advice to heart, at least up till now. I have tonight elected to shed the many-colored coat of rhetoric in favor of sackcloth because my thesis so contravenes the life-world of my audience that I fear they will not be able to adequately hear it. It is, quite simply, that a wide array of phenomena lumped together under the rubric of the “commercialization of science”, the “commodification of research”, and the “marketplace of ideas” are *both figuratively and literally* Ponzi schemes.

Most people have a rough idea of what I mean by a Ponzi scheme, even if they are a little hazy on precisely what it was that Charles Ponzi (1882-1949) or Bernie Madoff actually did. The phrase “Ponzi scheme” is a term of art in finance, but also a technical term in a tradition of macroeconomic thought, to which I shall return later.¹ A generic Ponzi scheme refers to any investment opportunity which dangles the promise of outsized profits through the hidden mechanism of paying dividends to early investors with money deposited by later investors. Of course, the intrinsic nature of a Ponzi scheme is that it can only continue in operation if the scheme attracts a surplus of credulous depositors funneling more money in than it has to pay out to vintage investors in the form of contractual dividends. More often than not, Ponzi schemes start out predicated upon legitimate investment opportunities, but rapidly cross the line to Ponzi status once the promise of outsized returns attracts an unruly stampede of unsophisticated investors. Indeed, whenever debt is used to prop up shortfalls of cash flow in the face of a weakened private balance sheet, the prospect of Ponzi finance is potentially opened up; but no one thinks increased leverage by itself is *prima facie*

¹ See Zuckoff, Mitchell (2005), *Ponzi's Scheme: The True Story of a Financial Legend*, New York: Random House; Edward Chancellor, “Ponzi Nation”, *Institutional Investor*, February 2007; and the work of Hyman Minsky.

evidence of fraud. The hallowed accounting distinction between ‘capital’ and ‘income’ is supposed to keep Ponzi phenomena at bay; but I think most people realize that such accounting distinctions are both arbitrary and porous. Hours before Lehman failed, it kept pleading it just was experiencing a liquidity crunch, until it was proven to actually be insolvent. Therefore, it will be important for my argument that my audience realize at the outset that tangible direct evidence of intention to defraud on the part of the impresario is *not* a necessary precondition for the existence of a Ponzi scheme. It is only at the later, more precarious stages of Ponzi finance that its proponents tend to start lying to clients, and maybe also to themselves. Only when things become untenable do the flocculent rationalizations of the wizards of the market start to shimmer in their true colors. It is up to you, my audience, to contemplate something similar in the case of science.

This thesis grows out of my own experience of working on two concurrent projects that I had thought were unrelated when I originally embarked upon them. The first was a decade-long attempt to understand the forces behind the progressive commercialization of science and the commodification of research which we have all been living through. That inquiry culminated in my latest book *ScienceMart*.² Much of the data concerning the commercialization of science that I shall point to tonight is documented in that volume. The second commenced in 2008, when it dawned upon me that the financial crisis then unfolding was resulting in the deepest worldwide economic contraction since the Great Depression of the 1930s. As an historian of economics and historian of science, I realized that this provided an unprecedented opportunity (although tempered by an awareness of the costs) to track the real-time reaction of the economics profession to what could only be construed as a bitter mortification of their prior pretensions and competence.³ Yet the more I became embroiled in the second project, the more I detected unsuspected echoes in the first. Plainly, almost everyone involved in the vast run-up of asset prices, derivatives and house prices in the decade prior to 2008 saw nothing but blue skies and bold benefits in the brave new expansion, during something Ben Bernanke rather imprudently called the Great Moderation. While I would not endorse the widespread complaint that “no

² (Harvard University Press, 2011). I had originally wanted the title to be *ScienceMart*TM, but repeated rounds of interventions by lawyers at the Press made me remove the trademark, and much else as well.

³ Philip Mirowski, “The Great Mortification,” *Hedgehog Review*, 12.3 (Summer 2010).

economist predicted the crisis”, it does seem pretty evident in retrospect that a serious understanding of the flaws in the financial folderol behind the economic expansion was generally absent.

I think it is safe to say that a disturbingly parallel boosterism currently dominates the huge literature on the contemporary commodification of science and the commercialization of the university. You can’t open a newspaper or peruse a blog these days without encountering ripping tales of “technology transfer” shaking up those erstwhile stodgy academic laboratories, ushering them into a fast-paced marketplace of salable intellectual property, frequently with visions of New Drug Applications dancing in the margins. Notably, a number of Science studies scholars have chimed in to praise the new regime.⁴ Money apparently just sits there waiting to be conjured up out of pure thought. Any self-denying ordinance abstaining from the headlong rush to covert scientists into entrepreneurs is to be renounced, banished in the dark to Plato’s Cave, languishing in the past. Commodified research has become the universal nostrum promising to deliver us from all evil, even unto rescuing us from terminal de-industrialization. It has been deemed a force so powerful and so inexorable that apparently even the current world-historical economic contraction cannot hinder its triumph; while I wrote this talk I read in the *Chronicle of Higher Education* that “Despite Recession, Universities Report Rock Solid Performance in Commercializing Inventions.”⁵ Whenever promoters and spinmeisters feel the need to tout the impregnable solidity of their schemes through both good times and bad, beware.

Just before the economic crisis hit in 2007, the CEO of Citibank (Chuck Prince) was reported to have said, “When the music stops, in terms of liquidity, things will be complicated. But as long as the music is playing, you’ve got to get up and dance. We’re still dancing.” Citibank in the next year had to be rescued by the government to the tune of 1.8 *trillion* dollars.⁶ It is a testimony to the parallels with modern science that Prince’s rationale is essentially the same refrain heard from every dean or vice-chancellor or politician when it comes to the commercialization of science. They seem

⁴ Steven Shapin, *The Scientific Life* (Univ. of Chicago Press, 2008); Shapin, “Commerce at the Helm?” *Science* 7 Jan, 2011 (331):33; Steve Woolgar, “Marketing Ideas,” *Economy and Society*, 2004 (33):448-462; Elizabeth Berman, “Why Did Universities Start Patenting?” *Social Studies of Science*, 2008 (38):835-872. I pass by the entire “Triple helix” and “Mode 3” literatures as well.

⁵ Goldie Blumenstyk, “Despite Recession...” *Chronicle of Higher Education*, Dec. 17, 2010.

⁶ This estimate comes from the Federal Reserve disclosures released in December 2010. See Sewell Chan and Jo McGinty, “Fed Papers show Breadth of Emergency Measures,” *New York Times*, Dec. 1, 2010.

never to have seriously considered the long-term structural consequences of their drive to commercialize research; nor, more to the point, do they ever provide a serious accounting of the Byzantine financial arrangements through which their offices of technology transfer attempt to tap the milchcows of science. Most of them have only a vaguest idea of what has been happening to intellectual property and the ‘structured investment vehicles’ of their faculty startups, much less the legal status of the university as a consequence of ‘monetizing their intellectual heritage’. All they know for certain is that their costs keep rising and their bottom line is currently under pressure, and that all their ‘peer institutions’ are doing it, and therefore they perceive no alternative but to keep on dancing, all the while hoping the music never stops. The comparison falters once we acknowledge that there is no governmental equivalent of the Federal Reserve to intervene in order to rescue universities deemed too big to fail, or too significant in the cultural patrimony to abandon. It is conceivable we might wake up one fine morning to find the entire US research base has absconded to China, and the intellectual landscape studded with a rust belt of abandoned campuses and cheap for-profit distance education firms. I do not stand here before you tonight to traffic in such dire predictions, although they do lurk in the background, foreshadowed as Act 2 in the Neoliberal Musical Follies. Rather, in the limited time available I want to lay out the striking similarities between the runup to the Great Recession and the current runup to the Great Recision of academic science. It will be sufficient if I can get you, the audience, to entertain the notion that the commercialization of science is destined to fail because it is a Ponzi scheme, pure and simple.

1. Detecting a Systemic Ponzi Scheme versus a Conventional Business Cycle

Simplifying drastically and shamelessly, commentary on the Great Recession has fallen into one of two broad categories: either it was the result of some normal or garden-variety malfunctions, the age-old stutter of the Capitalist engine – and therefore nothing to get too worried about—or else it betokened some deep structural flaw in modern capitalist institutions, a debility so deeply rooted that cosmetic surgery like the Dodd-Frank bill or so-called ‘quantitative easing’ by the Federal Reserve can’t begin to rectify the situation. Avoiding technicalities, let’s call the first the “Déjà vu” scenario, and the second the “Fictitious Capital” option.

The Déjà vu narrative is far and away the most popular and widespread class of commentary on the crisis in both the economics profession and in the popular press. It is the mainstay of almost all econometric work, which purports to survey crises across the centuries,⁷ as well as the kneejerk response to blame it all on “irrational exuberance” or “animal spirits”⁸ or ‘rational irrationality’ any number of other euphemisms for the “madness of crowds”. Whatever the facts on the ground, this is what most people desperately want to believe. The best-seller lists have been chock-full of this sort of stuff, which manifests itself in many variants over the last two years: for instance, there is the comforting tale that although some big investment banks were spewing out crappy or dubious assets, as long as you let the market innovate ways to bet against the dreck, then the smart investor will always eventually come out on top, and the market will right itself naturally.⁹ Alternatively, there was the fuzzy feel-good narrative pervading the mainstream media that if the banks would just ramp up their lending to 2007 levels, businesses would start investing once more, and things would return to normal. The hallmark of this class of explanations is the unspoken presumption that the market as a whole is just smarter than any of the colorful but deluded characters that occupy it from time to time. A different sub-genre of Déjà vu insists that the market participants would not have been led down the path to perdition if it were not for the misguided government distorting the eternal wisdom of the market: this has been elevated to the bumper sticker manifesto of choice for the Republican Party and their Tea Party affiliates. However, be they nominally Left or Right, the Déjà Vu contingent pledge their troth to the Nietzschean trope of Eternal Return: we can always go home again.

The Fictitious Capital Crowd, numerically smaller, paints a substantially different picture of the crisis. Their analysis begins with the premise that the economic theories which buttressed the sequence of bubbles dating all the way back to the 1987 crash have been seriously flawed; but more dire, they have misled market participants into creating all manner of novel assets and trading strategies that are literally groundless, in that they have no basis in sustainable profitability or stable economic

⁷ Carmen Reinhart & Kenneth Rogoff, *This Time Its Different* (Princeton Univ. Press, 2009).

⁸ George Akerlof & Robert Shiller, *Animal Spirits* (Princeton Univ. Press, 2009).

⁹ Michael Lewis, *The Big Short* (New York: Norton, 2010).

growth.¹⁰ The key to their core position is a flat-out rejection of the neoliberal dogma that the market is the greatest information processor known to mankind, more sagacious than any individual human could ever hope to be. The growth of the financial sector (and especially shadow banking) dwarfing all other activities, the widening of income inequality over the last three decades, and the progressive exacerbation of the sequence of bubbles all betoken an economic system gone seriously off the rails for the Fictitious Capital crowd. The pivotal insight is that markets have lost the capacity to distinguish between sustainable and unsupportable economic pursuits. While venality and corruption are accusations that are commonly launched by both camps, this class of explanations adopts the perspective that conventional economic theory has been used as a smokescreen to disguise the wholesale looting of the economic system by a cadre of technocrats and corporate figureheads who really didn't give a toss about the long-term survival of the system.¹¹ This is exemplified by, for instance, the SEC indictment that Goldman Sachs understood that the CDOs it issued would default, and explicitly bet against its own clients who purchased these wares while making money off both sides of the market; or the observation that the ratings agencies knew that the super-senior trenches of mortgage-backed securities did not warrant AAA status, but factored into their calculations the fact that their revenue came from fees paid by originators who needed the blessing of investment grade they could bestow. Whereas the Déjà vu contingent regards the Great Recession as just another swing of the eternal pendulum, albeit perhaps fortified with an extra jolt, the Fictitious Capital crowd regards it as a severe symptom in a longer-term chronic debility that besets the American economy.

Both narratives incorporate Ponzi schemes into their accounts, but treat them very differently—something of utmost importance for tonight's thesis. The Déjà vu crowd regards Ponzi schemes as regrettable isolated events, superficial symptoms of periodic outbreaks of localized irrational exuberance. Crooks, like the poor, are always with us. In their view, Ponzi schemes always percolate around the edges of any vibrant financial system; it is just that downturns in the business cycle happen to bring them out into the light of day. In their world, Bernie Madoff is just a minor passing distraction. Conversely, for the Fictitious Capital crowd, these Ponzi schemes are not

¹⁰ Yves Smith, *Econned* (New York: Palgrave, 2010); Joseph Stiglitz, *Freefall* (New York: Norton, 2010); Kathleen Engel & Patricia McCoy, *The Subprime Virus* (Oxford, 2011).

¹¹ Mike Taibbi, *Griftopia* (New York, Spiegel & Grau, 2010); James Galbraith, *The Predator State* (New York: Free Press, 2009). See also the film *Inside Job* (2010).

isolated incidents; over time, entire financial systems move from islands of relative stability through eras of increased leverage to reach a stage in which the preponderance of financial activity assumes the character of a Ponzi scheme. This happens over a much longer time horizon than the conventional business cycle, building for perhaps a half-century or more until the entire system is brought down by something like a Great Depression, itself a protracted affair.¹² Of course there are numerous other factors which comprise any given global crisis; but the overriding frame tale for Fictitious Capital is the transformation from a situation of reasonable profitability to a house built on sand where the participants have all but forgotten the fundamental principles of Real Capital. In the Neoliberal land of make-believe, if you can sell it, then it must *a fortiori* be legitimate. Fictitious Capital theorists suggest that, when Neoliberalism becomes the canonical guide to investment, Disaster eventually ensues with probability one.

I have spent a little time on this distinction, because I want to suggest roughly the same two camps mark the poles in contemporary science studies as well. The crux of the issue is how to think about the possibility that a science might experience a crisis of institutional organization at a particular historical juncture. Because I do not want this occasion to be misread as an extended critique of any particular authors, I will choose as my exemplar of the Déjà vu tendency in science studies an historian whom I respect immensely, and indeed, from whom I feel I have learned more about the socioeconomic institutional structures of 20th century physics than any other contemporary author—I speak here of David Kaiser. I specifically pick on Kaiser because he has *not* written about contemporary science. Instead, for years he has been working on a book entitled *American Physics and the Cold War Bubble*, where many of the arguments have already appeared as discrete papers.¹³ The crux of his argument is to use the metaphor of the ‘rational bubble’ to discuss the fate of physics in America from WWII to the 1970s as a kind of business cycle. As he writes, “Rising fastest and dropping hardest, physics set the trend in both good times and bad for larger transitions in American higher education.” To an economist, the story line is rather

¹² The conventional talisman for these types of theories is the work of Hyman Minsky, especially *Stabilizing the Unstable Economy* (New York: McGraw Hill, 2008); see for commentary, Philip Mirowski, “Inherent Vice: Markomata microfoundations for Minsky’s crisis theory,” **Journal of Institutional Economics**, December 2010, (6): 415-443.

¹³ The project is described at <http://web.mit.edu/dkaiser/www/CWB.html>. A similar sort of argument can be found in Nicholas Rasmussen, “The Midcentury Biophysics Bubble,” *History of Science*, 1997 (35):245-93.

distressingly familiar. Kaiser does not frame the problem in terms of different historical regimes of science organization, but rather in terms of mistakes and irrational exuberance.

In his account, the sciences do not generally expand and contract in any 'rational' fashion.¹⁴ One might expect that recruits and finance follow the inherent internal intellectual productivity of a scientific discipline at a particular historical juncture, but the evidence does not support such a conjecture. Instead, the factors which dictate a prospective expansion of a particular science themselves set in train all manner of outbreaks of misplaced enthusiasms, bureaucratic logrolling, Potemkin interdisciplinary ventures and irrational exuberance. For instance, Kaiser has one nice paper where he describes how many American physicists and government functionaries misrepresented estimates of the number of physicists being produced in the Soviet Union, in order to gin up further post-Sputnik funds for physics education;¹⁵ in another paper, he provides a salutary reminder to us in the 21st century that a fevered expansion in physics sometimes fostered a situation which attracted the wrong sorts of candidates, quoting a physics grad student at Cornell in the late 1950s:

I don't know about all of this romanticizing of physics. As far as I'm concerned, physics is no different from any other occupation. It is work. Like every other kind of work, it's a job. I'm interested in it because it so happens you can get very good jobs in physics that pay a lot of money, so long as you have a PhD. So that's why I decided to come to graduate school.¹⁶

What we observe here is a motley of individual Ponzi schemes, embedded in a larger boom, as individuals change their minds about what is real versus illusory in pursuit of self advantage. The system of physics expands unsustainably through the over-recruitment of unsuitable students (thus demanding more physics teachers), the over-promising of results to government paymasters (thus requiring over-hyped current discoveries), and the debasement of accounting standards.

Consequently, the aggregate size of the American physics community overshoot any rational assessment of academic and industrial needs, reversing itself with a lag

¹⁴ Kaiser himself makes the comparison to 'boom and bust cycles of financial speculation' in his 2008 lecture, which can be viewed on the Web at: <http://pirsa.org/08090000>. See also, David Kaiser, "[Scientific Manpower, Cold War Requisitions, and the Production of American Physicists after World War II](#)," *Historical Studies in the Physical and Biological Sciences* 33 (Fall 2002): 131-159.

¹⁵ David Kaiser, "[The Physics of Spin: Sputnik Politics and American Physicists in the 1950s](#)," *Social Research* 73 (Winter 2006): 1225-1252.

¹⁶ Quoted in: David Kaiser, "[The Postwar Suburbanization of American Physics](#)," *American Quarterly* 56 (December 2004): 851-888.

when exponential expansion met the rise of détente in the 1970s and cuts in defense spending, not to mention the bloodbath of in-house corporate labs in the 1980s and 1990s. Since the 1980s physics has entered a tailspin from which it has yet to recover. Kaiser's work fits nicely in science studies because he shows how the nuts and bolts of everyday physics, from the nature of pedagogy to the repudiation of philosophical discourse, depended directly upon the phase of the cycle that physics found itself in. Kaiser has explored the ways in which this debacle might be attributed to either irrational exuberance, or else a 'rational bubble' where participant scientists rode the wave, thinking they personally could safely exit the discipline before the real hard times hit, no matter what happened to their less limber peers. Physicists and *hubris* are two words which tend to go together, say, like 'economics' and 'dismal'.

The point I want to make tonight is that this is a straight-up Déjà vu account of the business cycle, only now extended to the cover the expansion and contraction of individual sciences like physics. Both economists and the physicists themselves failed to predict manpower requirements accurately in both boom and bust; past levels of funding were not good predictors of future budgets; the true level of sustainable physics activity was known only to the market itself. Indeed, one might indicate the Déjà vu account posits the science studies equivalent of the Efficient Markets Hypothesis here: no science can predict its future trajectory from its past track record; the ecology of human knowledge is far too complex to be planned, and can only be adequately nurtured and expanded by the greatest information processor known to humankind, namely, The Market.¹⁷ Indeed, one could venture further to assert that the Hayekian 'spontaneous order' of physics was roiled by a cycle in the first place mostly because of misguided Cold War government intervention. Anyone following the crisis literature over the last two years can easily fill in the blanks as to how this story would play out.

In the remainder of the lecture, I want to contrast the Déjà vu version of science studies with something more akin to the Fictitious Capital narrative. Here the alternate account would suggest that the sciences as a whole have undergone phase transitions between distinct regimes of science organization and funding over long stretches of

¹⁷ It is clear from my correspondence with David Kaiser that he would not wish to endorse this particular gloss upon his work. Nevertheless, one can anticipate that this interpretation could easily be developed from the trends already found in science studies indicated in footnote 4 above.

history, rather than cycles around some center of gravity through time.¹⁸ Pure intellectual productivity rarely dictates the optimal size of a scientific cohort. Individual sciences do not experience simple harmonic motion in a timeless Market, but instead traverse rise and fall within the ecology of other sciences, themselves promoted or demoted by shifts in the changing combinations of corporations, governments and universities that sustain the science base in any particular historical era. In the United States, there have existed at least three major regimes of science organization over the last century or so; in the interests of brevity, we shall only make reference to the latest two, the Cold War regime that extended from 1940 to circa 1980, and the Globalized Privatization regime that persists down to the present day. It would take us too far afield to even enumerate all the critical ways modern commodified science differs from the ways that science that was prosecuted during the Cold War: from weak intellectual property to fortified globalized IP, from in-house corporate labs to offshore outsourced commercial research, from academic research hospitals to contract research organizations, from authorship as craftwork to ghostwritten and ghost management of the journal literature, from tenured self-organization to flexible short-term contracts, from peer review to research vetted by phalanxes of lawyers, ... the list just goes on and on.¹⁹

To cut through the complexity, and abstain from straining your patience, I will tonight propose a few broad and stark generalizations about the modern regime of Globalized Privatized science from a Fictitious Capital perspective. The first is that the expansion and contraction experienced by a science is a direct function of the regime of science organization within which it is embedded. This is the great flaw of the Déjà vu perspective. Thirty years of profound changes in how science is organized have now become so deeply ingrained and pervasive in our society that there is no option to return to the way things were in the Cold War regime. Even if the Defense Department decided tomorrow that it wanted to recapture its role as science manager in chief in the US, it could no longer work the inspirational magic it did in the 1940s-60s, if only because the military itself has now been thoroughly privatized in structure and

¹⁸ This was first suggested in: Philip Mirowski & Esther-Mirjam Sent, "The Commercialization of Science and the Response of STS," pp. 635-689 in Ed Hackett, Olga Amsterdamska, & Michael Lynch, eds., **Handbook of Science, Technology and Society Studies**, MIT Press, 2007

¹⁹ An attempt to portray the many-sided nature of the new regime can be found in the special issue of *Social Studies of Science* devoted to 'Neoliberal Science', October 2010 (vol.40, no.5).

management of its activities. Furthermore, the current government is no longer interested in footing the bill for your higher education as a preparation for your citizenship in the modern democratic state; rather, it wants you to pony up for all that 'human capital' you accumulate, supposedly to your own benefit. And then there are the landmark Court decisions, ranging from **Diamond v. Chakrabarty** to **Madey v. Duke** and **Laboratory Corporation v. Metabolite Labs**. There have been just too many irreversible changes on many fronts in corporations, government and the modern university to simply reverse the Neoliberal drive to commodify knowledge. There is no going home again.

The second generalization is perhaps even more disturbing, once we absorb the implications of the first. We are living in an era where the individual sciences are again being subjected to dramatic amplifications and contractions, as universities are redoubling their commitments to the natural sciences, often at the expense of the humanities and other non-instrumental fields of study. Some might suspect this is just another instance of the cyclical overshoot during the Cold War described by historians such as David Kaiser. From the Fictitious Capital perspective, however, what is noteworthy about the current regime of Globalized Privatization is the extent to which American science has lately become infested with speculative bubbles, or if you will, Ponzi schemes. Viewed through the lens of a structural regime change, and not as simple business cycle, there are warning signs here equally as dire as those preliminary financial bubbles that burst in the runup to the Global crisis in 2007-9. In the name of promoting science through commercialization, the champions of checkbook research misrepresent short-term paper gains as long-term sustainable maintenance of a science base. It matters little whether they truly believe their own publicity or not. They expend tremendous ingenuity in robbing Peter to pay Paul in the name of rendering science more 'responsive' and 'accountable.' To reiterate my title, the current regime of Globalized science privatization is built upon a scaffolding of Ponzi schemes. Combining this with the first thesis, it is difficult to discern how an impending crash of American science can be avoided.

Perhaps it is best to leave the dark augury of a bleak doppelganger to the Great Recession to the question period. My task in the remainder of this lecture is to show you

what a Ponzi scheme looks like when it comes to the organization of science, and to ask how the system persists in its bankrupt practices.

2. Three Modern Black Boxes in the Commercialization of Science

I once attended a lecture by Karin Knorr-Cetina, where she reflected upon the science studies metaphor of the 'black box'. Normally, this refers to a process of imposing closure upon previously contentious issues in a science, in the interests of getting on with cutting-edge research. Scholars in science studies like to assert they demonstrate the social character of science by 're-opening the black box,' that is, when they resuscitate the latent possibility of indeterminacy and dissent, through historical research, or participant observation, or political intervention. Professor Knorr-Cetina suggested that, in her view, perhaps the boxes were no longer quite so black as they used to be, due to the modern commercialization of science. As proprietary science was broken down into its deskilled component activities, divided up and outsourced to lower-cost providers, the ability to peremptorily stifle debate and designate certain questions beyond the pale should prove more difficult to accomplish, if only because of the need to regiment so many more diverse participants. She then proceeded to say that, in her opinion, the more durable black boxes tended to be found, not in the natural sciences, but rather in economics and finance. While I personally am not quite so sure that commodification automatically renders research more transparent to its participants, I fully concur that the black boxes of finance and economic infrastructure have proven far more impervious to the scrutiny of science studies than, say, the arcane world of gravity wave research or the vicissitudes of AIDS research.

To rectify this situation, I will briefly survey three black boxes of the modern Global regime of Privatized Science, and suggest that what we will find when we open each is, you will not be surprised, a Ponzi scheme. I stress at the outset that I am not the first to say this, just as in retrospect we notice there were some prudent folks insisting that CDOs-squared were a prescription for disaster in 2006. What is perhaps original on my part is that, by prying these black boxes open here on one platform, and setting them down side by side, we might begin to see that there is something shared in common, something structural about the modern commercialization of science that suggests the entire macrosystem is intrinsically unsustainable. We will then close by pointing to the theory of political economy that has promoted both the financial debacle

of the Great Recession and also the impending catastrophe of the commodification of science.

The three black boxes we shall peer into briefly are: (1) the biotech model of the startup firm; (2) the university technology transfer office; (3) the privatized scholarly journal and the perversion of for-profit bibliometrics. Each displays many of the fundamental characteristics of a Ponzi scheme.

A) The Biotech startup firm

The Biotech startup firm is a special kind of firm dedicated to science for sale, usually generated in the first instance by university faculty, perhaps through the intercession of one of those startup incubators sprouting up around university campuses, often with some form of university based investment as well. Although something vaguely resembling this type of firm can be found dating back to the early 20th century, the modern biotech model really dates from 1980, with its intimate relationship to the rise of the venture capital investor, and a spate of dispensations allowing faculty to keep their day jobs while running their own private firms on the side. The business school literature has conducted a love affair with the biotech model for decades now, so I must direct my audience elsewhere for an elaborate history of the form. Nevertheless, I hope people familiar with science studies are prone to realize that the biotech model is not the product of technological determinism.

When one cuts through the star-struck jargon, what the new biotech model amounts to is the outsourcing of many of the upstream R&D functions that had previously been performed in-house by the large Pharmaceutical firms to this unruly sector of small startups and spinoffs from academic settings (and more recently from the NIH itself). Big Pharma has offloaded much early-stage funding of the research onto the universities and the venture capitalists, who pour resources into supposedly commercial projects with no other visible means of support. The biotechs themselves attempt to milk their internally generated research tools for cash up front, or more likely, they try to negotiate temporary joint R&D projects with the Pharmaceuticals industry for a little more cash infusion to offset giddy 'burn rates' of finance;²⁰ this has proven a particularly cheap way for Big Pharma to monitor new R&D without having

²⁰ In one estimate provided by the trade group Biotechnology Industry Organization, of the 370 publicly traded American biotechs, 125 had less than six months cash on hand (Pollack, 2008). Since this organization exists to present the model in its most flattering light, the situation was probably more extreme than that.

to foot much of the bill. If the research actually goes somewhere, the VCs and the star scientists cash out with an IPO, and retire to Palm Springs; but this does not mean that the biotechs are actually showing a profit, or are even viable. For the stark truth is that most biotechs never produce a drug or other final product; they are just pursuing commercial science, *which almost never makes a profit*. This is frequently hidden by the fact that true Nirvana for the biotech sector is to have a successful IPO followed by a lucrative buy-out by a Big Pharma firm. In such cases Pharma is happy because it has bought a near-end stage drug development sequence; and the firm itself disappears into the maw of an existing corporate structure.

The dirty secret of the biotech model is that, if one removes one or two outsized success stories (primarily Amgen and Biogen) from the mix, then the biotech sector as a whole has persistently lost money since the mid-1980s. “It used to be a joke to say that ‘biotechnology companies are pharmaceutical companies without sales’;²¹ but how amusing can it be when a major booster of the industry, *Nature Biotechnology*, wrote in its summary “State of the biotech sector—2007” that “The biotech sector as a whole narrowed its loss by 64% to \$2.7 billion... This is the closest the industry has come to breaking even” (July 2008, p.728)? And that was before the onset of the financial crisis. A more recent survey of the biotech sector by PriceWaterhouse bewails that, “the business model on which Biotech has relied for the past 30 years is breaking down... In March 2010, [ten-year investment rates of return for the entire sector] had plummeted to -3.7%.”²²

Theorists of the current crisis take note: *Commercialized outsourced pharmaceutical science in the aggregate (viz., the ‘upstream’ biotech model) has not been a viable profitable system*. This fact is compounded by the further observation that the drug pipeline of truly novel therapies has been acknowledged to be “drying up” over the last decade or more.²³ We repeat that this regularity was well established *before* the general economic

²¹ For evidence of money loss: (Pisano, 2006b, p.115; Coriat et al, 2003, p.238) . For the quote: (Gottinger & Umali, 2008, p.584).

²² PriceWaterhouseCoopers, *Biotech Reinvented* (2010). Much of the data quoted herein was derived from a study of biotech rates of return by Ian Cockburn & Josh Lerner paid for by the venture capital industry; there is some reason to suspect their reported 44% failure rate in biotech firms is on the low side.

²³ The main sources on this worrying trend are: (Nightingale & Martin, 2004; Hopkins et al, 2007; Angell, 2004; Aggarwal, 2007).

crisis of 2007-2009. The biotech model is unprofitable as a whole, and moreover, does not produce the 'goods'.

It is truly curious that this combination of facts are not more widely known and appreciated. Much of the obscurity surrounding this state of affairs undoubtedly is related to the highly-charged circumstance that it makes universities and governments falling over each other to join the biotech gold rush by fostering their own corporate spinoffs look really foolhardy.²⁴ But there is also the complicating circumstance that the biotech sector has enjoyed a sequence of a couple of waves of infatuation in the stock market since the 1980s; that phenomenon would be very hard to understand if the sector really were the walking wounded, as we have maintained. The key to grasping the apparent contradiction is to acknowledge the biotech firm is primarily a financial artefact, and not a special kind of scientific research protocol.

If a phenomenon is purported to all appearances to be a success when careful measurement reveals it is a failure, then one must widen the scope of the analysis in order to comprehend the sources of its staying power. The case to be made here is that the biotech model does indeed fulfil various needs and perform various functions, even though the economic process it most closely resembles is the time-honored Ponzi scheme: that is, it regularly incurs more liabilities than it accrues cash flow, with the trick being to lure exponentially increased investment and then to cash out before the inevitable collapse ensues. The main urgency that the biotech model assuages are the strategic needs of big Pharma to outsource most of its R&D process, while still remaining dependent upon profitable 'science-based' product development. In a very real sense, the biotech model owes its very life support to Big Pharma, both through periodic infusions of joint-project financing deals and the small but real prospect of being bought out by a major. Sometimes the biotech might actually manage to charge for something Big Pharma needs for its own purposes, like specific research tools, or else access to IP controlling broad therapeutic areas, like gene patents; but this never constitutes a major persistent revenue stream. Such dribs and drabs of cash flow could never justify the growth of the sector. The secondary functions it performs are to

²⁴ See (Dewan, 2009). The implications of the failure of the biotech model are so inflammatory, and so opposed to the interests of so many "new knowledge economy" actors, that the neoliberal think tanks have recently began to mount a counterinsurgency to argue there is no real problem. See (Buckley, 2007; Caulfield et al, 2006; Adelman & de Angelis, 2007).

provide a steady stream of apparently legitimate high-tech IPOs for the entire panoply of financial managers: venture capitalists, funds managers, IPO specialists, merger and acquisitions specialists, and the like. “A ‘banner year’ in biotech has come to mean a year in which financing is plenty and the IPO market is hot. So in no sense has the biotech model been a freestanding ‘success’. Few have noted that the timing of the birth of the biotech model was intimately related to changes in the finance law which limited the liability of venture capitalists and the pension funds that invest in them²⁵. Fewer still read the financial pages: “Aggregate biotech returns have historically been strikingly mediocre...Furthermore, there are large numbers of biotech walking dead—companies that survive without tangible returns to investors... Against this backdrop, it might seem puzzling that the capital markets continue to fund the biotech sector” (Booth, 2007, p.854).

But most Ponzi schemes look like that in retrospect.

B] The University Technology Transfer Office

The commercialization of university science has been a long-term project; it is silly to suppose the Bayh-Dole Act simply uncorked the lamp and let the genie of ingenuity escape. It took an inordinate amount of work to construct the ‘knowledge commodity’ that would supposedly provide the deals which would sustain the university bottom line. Much of this happened through the instrumentality of the university technology transfer office [TTO], the history of which has been covered in greater detail in *ScienceMart*. The construction project is still ongoing, but it is not so clear that it has been working out all that well. Furthermore, it has not been simply a matter of finding all sorts of pre-existent commercialization opportunities dangling as low-hanging fruit begging to be harvested by entrepreneurial universities. TTOs have had to beat the bushes and reorient their faculty, and even then, numerous obstacles prevent the successful appropriation of intellectual property by the modern university. After all, if a discovery was inherently all that promising, why hasn’t someone else already entered a pre-emptory claim? Indeed, in a fact not often admitted by TTOs but current among commentators on the modern university, once you take the full costs of TTOs into account, *very few universities make any money whatsoever, much less serious*

²⁵ For the quote: (Pisano, 2006b, p.162). For the observation on finance markets: (Robbins-Roth, 2000, p.34).

*revenue, from management of their IP assets.*²⁶ This curious situation forces us to contemplate the notion that the modern operation of the TTO likewise resembles that of a Ponzi scheme.

The TTOs parallel Ponzi schemes in that they start out with good intentions, but have to adjust to the fact that there is no way their costs and payouts can be kept in line with their operating revenues. Consequently, they resort to highly deceptive accounting, if only to hide the fact that current expenditures far outstrip current revenue. The Association of University Technology Managers has fostered the bad habit of reporting only gross revenues in its various widely-quoted survey results, as do many individual university TTO reports. It would be as if a firm only deigned to report its gross sales, neglecting to post any costs whatsoever, in order to trumpet its stunning pecuniary success. These costs for TTOs range from the obvious current expenses of salaries, overhead and the like to the less obvious costs of the hindrance of research itself, not to mention the degradation of the Intellectual Property obtained. I give just one example of each below. This sloppy accounting for the costs of ‘technology transfer’ serves to hide a multitude of sins.

Engrossing and policing IP is an expensive process; that is why many actual commercial industries have historically declined to pursue it with great avidity. Mostly it has been concentrated in a very few industries, like Pharma, chemicals, computers and entertainment. If you are intending to become a player, you have to be willing to take the gloves off and litigate on a regular basis. It is common knowledge that few university TTOs manage to cover their current bureaucratic expenses with their license revenues; beyond that, they are distinctly loath to admit they have been suing other universities or even their own students over some crass IP disputes, and rarely report either their court awards or their spiraling attorney fees as part of the commercialization calculus. This is indeed one major factor behind the inexorable proportionate rise of administrative employees to the detriment of faculty employment in the modern American university. Yet few are willing to enter that administrative bloat on the liabilities side of the commodification ledger.

²⁶ This is admitted, to a greater or lesser degree of serious documentation, in (Powell et al, 2007; Greenberg, 2007; Geiger & Sa, 2008; Newfield, 2008, chap. 12). I exclude from this statement some windfalls that accrue from the increasingly acrimonious litigation which universities have incurred in their pursuit of the profits of science.

- But one also has to consider what has been happening to patents and IP in general under the Privatization Regime. Universities jumped on the patent bandwagon in part because patents were becoming easier to get in general, and the rights of holders had just been inordinately strengthened since 1980.²⁷ In effect, patents now covered less real knowledge, but their individual sting had been inordinately fortified. As long as academics were slow to punish others for previously tolerated infractions, no university was going to get rich by grasping at that tarnished brass ring. Yet by the same token, the patent system was simultaneously itself becoming more dysfunctional: Jon W. Dudas, the Undersecretary of Commerce for intellectual property under President Bush, was reported to have said: “We are getting more and more unpatentable ideas, worse and worse quality applications. Historically, in the last 40 years, the allowance rate — the percentage of applications ultimately approved — hovered around 62 percent to 72 percent. It went up to 72 percent in 2000, but dropped to 43 percent in the first quarter of this year [2008].”²⁸ There is a huge literature debating the reality and extent of patent degradation in the US; but for my current purposes, it is enough to observe that the drive of the modern university to pursue patents with a vengeance just as the patent has become debased gives rise to a curious Gresham’s Law: chasing IP has not produced a reliable revenue stream, and worse, the coin has suffered debasement as a consequence of the quest.

But there is another sense in which the TTO office sports a Ponzi-like duplicity. They focus on numbers of patents granted as the advertised ‘metric’ by which they gauge success, while hiding the fact their strategems are not generally making serious money for the university, thus diverting attention from the fact that they have misrepresented the ways their activities have impaired the ultimate purpose of the university, namely, the quest for new knowledge. There is a huge literature in economics which seeks to argue that the pursuit of patents does not hurt research; but that literature curiously ignores the full panoply of IP that necessarily must accompany

²⁷ This is documented in Adam Jaffe and Josh Lerner, *Innovation and its Discontents*. (Princeton Univ. Press, 2004).

²⁸ Quoted in: Robert Pear, “Patent Law Battle a Boon for Lobbyists,” *New York Times*, April 30, 2008. Patent grants have exploded after Dudas left office, leaving some to wonder if the Obama administration has permitted the situation to degenerate even further. See: <http://inventivestep.net/2011/01/17/uspto-issues-record-number-of-patents/>

patents, if science is to be thoroughly commodified. A major symptom of this corruption was made manifest through the Material Transfer Agreement.

I will spare you a law school tutorial tonight; it will suffice to Define the MTA as a contract which exercises due diligence in the pursuit of patents by imposing all sorts of prospective obligations on anyone who seeks access to any research materials related to a line of inquiry staked out by prior researchers. MTAs can impose all manner of obstacles on other researchers, from reach-through claims on future IP for discoveries that don't yet exist, to prior embargoes on publication, to impositions of secrecy with regard to third parties. All of this happens long before a patent is applied for. Corporations had long had resort to MTAs to pursue IP strategies, but universities only started becoming party to such agreements in the 1980s. It is common knowledge that scientists complain far more about their frustrations with MTAs than they do about patents. That's because patents are old news, while MTAs bite in real time.

Faculty initially regarded them as an irritant, and TTOs were not much more welcoming. Universities really don't make money off MTAs, and they have never been used as a metric of TTO success. However, as a subset of scientists were increasingly drawn into the commercial sphere, they saw it might be in their interest to themselves attach MTAs to research inputs requested by other academics; and thus began a tidal wave of MTAs which shows no sign of abating. Furthermore, all attempts to render MTAs relatively harmless by restricting their conditions to a few innocuous clauses have failed repeatedly, as many strenuous IP-related restrictions have been loaded into individual MTAs. One of the more important codicils dictates that the existence and content of MTAs themselves be treated as secret and proprietary.

The reactions to this deteriorating situation have been curious. First, the scientific community, and in particular the academic biomedical community, has stratified into a commercialized elite who essentially see nothing wrong with encumbrance of the research programs of those they consider interlopers, mainly because they already have all the access to research tools that they desire, and conversely, the bulk of less well-apportioned scientists, who have been painfully learning to adjust to a research environment studded with IP booby-traps. Likewise, the TTO community has largely become inured to MTAs, but relegates them to low-status employees, and does not monitor them very closely. Hence research into the extent and implications of MTAs in

universities has become occluded, and sometimes actively blocked. Responding to the grumbling of the proletariat, as well as some studies funded through biomedical foundations, organizations supposedly charged with monitoring and lobbying for the health of science such as the National Academy of Sciences and the AAAS have commissioned studies of the phenomenon, but for reasons which still require further illumination, they have sought out social scientists of neoliberal inclinations to conduct these surveys. Almost uniformly, the surveys conducted by these same social scientists conclude that patents on research tools and ideas have had little deleterious effect upon the research process; and furthermore, if and when they consider MTAs, they invent special dispensations to explain away any harmful effect the MTAs might have had. Yet, careful review of their surveys reveals the levels of discontent they uncover among the relevant academic communities do not differ so very dramatically from the levels found in more alarmist surveys by biomedical professionals and by analysts of the biotech firm sector, both of whom have pretty uniformly raised warning flags concerning the frustration of research traced to the commercialization of research inputs.

So something is wrong here; but promoters of technology transfer have turned their backs on acknowledging that this dynamic cannot be sustainable, because it is based upon a beggar-thy-neighbor policy. The real embarrassment of this trend for university TTOs is the concomitant rise in *outgoing* MTAs, and in particular, MTAs going out to other universities. It is one thing to blame the trend rise in MTAs upon rapacious corporations and their crafty legal departments preying on innocent universities by imposing outrageous restrictions on research, but it is quite another to acknowledge that the university sector has been doing more and more of this to itself. Bluntly: business models are forcing universities to gouge other universities in the pursuit of knowledge. If this specific trend were more publicized and better known, then much of the echochamber rhetoric about the utter blamelessness of the TTO in scientists' complaints about holdups of the timely pursuit of research would collapse. It very much contradicts the standard image of technology transfer as the university doing what it always did before 1980, only now with the TTO merely speeding up and facilitating the 'transfer' of findings to an external commercial organization, and grabbing some of the benefits. If the university itself becomes more commercial, then it

must start acting more like a firm, which means using its IP offensively as well as defensively. There is no such thing as exerting fortified control over downstream 'outputs' of scientific research from the university without the blowback of seeing that control creep back upstream into early-stage research, especially when the corporate biotech sector has been pushing trends in the same direction. The growth of outgoing MTAs in the modern research university is thus another dirty little secret of the new century. It is the IP that dare not speak its own name.

C] The Privatized bibliometrics of the scholarly journal

The third Ponzi scheme I will discuss tonight is not really as literal a matter of faking profitability, as in the first two instances of the biotech model and the TTO. This scheme tends to be profitable in a literal pecuniary sense; but it nevertheless displays certain Ponzi aspects in the epistemic sense. Recall Ponzi schemes misrepresent the growth rates of their activities by rigging the books. Basically, what I will argue is that as statistics concerning science themselves became more privatized and Commodified, the firm involved has misrepresented the growth rate of science itself as part of its business plan.

What could be more boring than bibliometrics, the measurement and statistical manipulation of metadata concerning scientific books and journals? After all, we all know that counting numbers of articles and citations is not really the same thing as measuring the output of science. Much of bibliometrics started out as a harmless research tool to help the individual scholar find her way through the journal literature, tracking relevant articles and attendant ideas. But like so much else, as it was transformed in the modern regime of Global Privatization, it became something much sharper, and less innocent.

Bibliometrics gain power and salience by allying itself to the commercialization of research. The so-called rationalization of the university through research commodification requires more and more metrics to feed the bureaucracy, and provide short-term indicators of performance, since science has itself previously resisted quantification and has in the past proven recalcitrant to Taylorist techniques of micromanagement. The rise of bibliometrics as a management tool coincides with the disempowerment of the faculty in the modern university: statistics pre-empt personal judgment of research. Interestingly, it has been the intensification of IP and the

neoliberal exaltation of competition that has fostered the increasing centrality of bibliometrics: that is, the collation and retailing of publication counts, citation statistics, word searches and cross-references, and all their cognate products, such as journal impact factors, faculty and departmental rankings, world university rankings,²⁹ and all the rest. The commercial automation of research evaluation finds its obligatory passage point through the temple of bibliometrics.

Few realize the extent to which the major source of world-wide bibliometric data of this sort is a private for-profit company, and thus the exact composition and content of the data discussed below is proprietary, and more than a little secret, in keeping with the character of the modern regime of science organization.

Tonight I will restrict myself to the Thomson/Reuters databases.³⁰ Its product *ISI Web of Knowledge*TM allows those with access to follow citation links across something on the order of 16,000 journals, to retrieve articles cited or citing a specific initial article. But broad-based does not mean truly inclusive (Testa, 2003); as both Garfield and later ISI representatives have stated unequivocally, the range of journals to incorporate into the database is an *economic* decision it reserves to itself. Sometimes this is justified by an appeal to the so-called 'Bradford's Law', viz., the observation that a small number of journals publish the bulk of 'significant' scientific results; yet the problem of the lack of openness of the decision process remains. ISI was acquired by Thomson Scientific & Healthcare in 1992, became known as *Thomson ISI* and now as Thomson Scientific. It is currently a component of the multi-billion dollar Thomson-Reuters Corporation, formed from the 2008 merger with Reuters, a major provider of financial data and business journalism.

It would take a book in and of itself to explain the phases of transubstantiation of a tool that started out as something harmless, rather like a thesaurus, into a sharp-edged audit device wielded by bureaucracies uninterested in the shape of actual knowledge and its elusive character. In particular, Thomson now retails its products as a one-stop shop for corporate monitoring and control of intellectual property in its many incarnations. Furthermore, many university ranking exercises and bureaucratic audits

²⁹ See, for instance, the Thomson Reuters driven World University Rankings at: <http://www.timeshighereducation.co.uk/world-university-rankings/2010-2011/physical-sciences.html> .

³⁰ The rival services of Elsevier's *Scopus* and Google *Scholar* are discussed in *ScienceMart*, mainly to point out the ways in which they have not been put to the uses that we identify as important for Thomson ISI.

are based solely on the Thomson datasets. Threatened on the one hand by Google Scholar, introduced in 2004, which is (after all) free, and much easier to use for the average researcher (Noruzi, 2005), and on the other by the ongoing consolidation of academic publishing by a very few conglomerate firms doing battle with numerous 'open source' e-journal startups, Thomson has increasingly sought to position the Web of Science as another high-cost limited access database in a portfolio attuned to the special needs of corporate and administrative clients—thus the logic of the merger with Reuters. You can't make real money by providing academics with personal research aids. Consequently, Thomson Scientific does not strive to measure many things its older clients might wish it to measure.

The upshot of these considerations is that everyone who in the past sought to use bibliometric measures as indices of scientific output have been effectively forced to make use of the products of Thomson ISI. The NSF does so almost exclusively in its *Science and Engineering Indicators*; consequently we shall follow their lead, albeit gingerly, gingerly, since it will be imperative to point to the flaws of these measures at every step along the way. What the NSF has been straining towards is the identification of some plausible quantitative indices of broad changes in science publications over time. As every statistician knows, this is only possible if the underlying basket of things measured stays relatively invariant over time; or if that is unattainable, changes in the basket are controlled and documented so that they can be linked backwards to earlier measurement data. Yet this is precisely something Thomson refuses to do (although its officers might retort that it is not the job of Thomson to provide that service).

Take, for instance, the question of what is happening to the number and distribution of scientific publications over the range of the globalized privatization regime, say, since 1980. Thomson acknowledges that this could potentially be accomplished by tracking a fixed set of journals, but Thomson instead constantly revises what it considers to be the 'core set' of scientific journals by its own opaque decision criteria, without providing adequate comparative data which would permit overlaps of 'old' and 'new' core sets. And the rate of change as to the 'core set' is not trivial: reportedly, Thomson's core set encompassed 4460 journals in 1988 and 5262 journals in 2001. It is not that the provision of statistics based upon an invariant core set are in principle impossible; it is just that because Thompson is not forced to do so by the

government, and corporate clients are uninterested in an invariant core set, then they simply neglect to do so.

To answer any moderately interesting question about American science, numerous sticky and fine-grained modifications would have to be made to the Thomson databases. For some time, the NSF itself had outsourced the production of bibliometric indicators for *Science & Engineering Indicators*, and hence the reprocessing of Thomson ISI data into fixed core sets, to a separate private firm, namely, CHI Inc. When Francis Narin retired and sold CHI, the NSF seemed to lose interest in the process, and no one was left minding the store. This illustrates some of the problems of government outsourcing key decisions over knowledge gathering and collation to private firms. Much of the standard data concerning American science in *Science & Engineering Indicators*, has, to put it mildly, become corrupted over the recent past.³¹ It seems the definitions of “science” sought by Thomson’s clients bore little relationship to serious definitions of output sought by contemporary scholars of science policy and science practice.

This little problem has a myriad of consequences for all manner of uses of Thomson databases, but we will confine ourselves tonight to the question of what has happened to the number of scientific journal articles published by American authors over the last three decades of the Globalized Privatization regime. The NSF and many science policy scholars have here taken the position that absolute levels of US scientific publication have ‘flattened’ for a decade or more.³² But an equally persuasive case can be made that we are living through a period of absolute decline of published scientific output in the US (Hicks, 2007; Adams, 2007). Let us briefly examine some of the evidence.

While there are many bits of evidence gathered together in Chapter 6 of *ScienceMart*, I will tonight just provide one table of data suitably adjusted to preserve a fixed index number through time starting from the Thomson databases, presented in a separate NSF report, but *not* in the *Science & Engineering Statistics* compendium. What I find fascinating about these figures is that the sectors most responsible for the global

³¹ See *ScienceMart* (2011, pp. 18-20, 123-125, 263-4,280).

³² See, for instance, (Mervis, 2007; NSF SRS 2007; NSB 2008a, p.5-36; Guess, 2007). One example of how the *Companion* (NSB 2008b) broke ranks with this consensus was its willingness to discuss ‘declines’ in article output.

privatization regime are also the ones most responsible for the US publication decline. Biology and clinical medicine, the favored sons of the privatization regime, have experienced contracting publications since the early 1990s in the US; but rather more unexpectedly, so have mathematics and the social sciences. Indeed, one of the more striking facts about modern science in the US is that the contraction has occurred across the board, with only a few minor exceptions.

Table 1
US author Publications, various sciences, fixed journal set

Date	Clinic Med.	Biology	Physics	Mathematics	Social Scis.
1988	53,512	12,730	17,883	3856	8303
1989	55,592	13,421	18,923	3972	9041
1990	55,516	13,922	18,907	3239	8917
1991	55,428	13,664	20,098	3329	8682
1992	55,516	12,885	19,632	3429	8535
1993	55,794	12,061	18,946	3394	8389
1994	55,362	12,134	19,652	3185	7719
1995	55,535	11,857	18,815	3013	7704
1996	54,220	11,266	17,992	3076	7383
1997	52,948	11,050	17,146	2788	7047
1998	52,421	11,057	16,945	3072	6984
1999	52,631	10,059	17,017	3017	6917
2000	50,186	10,970	15,965	2984	6612
2001	50,569	10,864	16,376	2834	6826
2002	47,782	11,416	15,809	2771	6369
2003	51,278	11,824	17,115	2895	6778

Source: (Derek Hill et al, 2007, *Changing Output of Scientific Articles 1988-2003* App Table 2) from data supplied by Thomson ISI, fractional counts; units are single articles

I am sure many in my audience stand ready to challenge the relevance and meaning of these numbers, not to mention the dubious proposition that article counts are a valid index of the output of science. But that is not the point of my raising them here tonight. It is, rather, to highlight the Ponzi-like character of the behavior of Thomson Reuters, and the complicity of the NSF in playing along with the deception.

Thomson Reuters, given its business niche, is utterly uninterested in providing consistent timeseries on the global state of science. Even though some of its clients ignore that fact and blithely push ahead to utilize their data to make various intertemporal comparisons, not to mention as input to all sorts of ranking exercises, is of little concern to the private data provider. After all, who at Thomson Reuters wants to sound the klaxon about the contraction of publications in the most self-characterized 'knowledge society' in the world? Thomson Reuters above all wants to portray science as inexorably successful, and accomplishes this by adding more journals, more statistics, more rankings to its databases, even when actual scientific output may be flagging in some sectors or countries. This is epistemic Ponzi, which works only so long as no one demands a serious accounting.

And then, how about the NSF? Here we are situated three decades into the ongoing privatization of science, with appreciable increases in research spending by the NIH and NSF over this recent horizon, and then the possibility of a distinct contraction of American scientific publications rears its unwelcome head. Wouldn't that prove an uncomfortable embarrassment? NSF is aware this possibility, since it has commissioned some of its own researchers to reprocess the Thomson data to see if the phenomenon is real. However, they chose to bury the results in a statistical memo no one reads, and proceed to broadcast the misleading notion in *Science and Engineering Indicators* and *Science* magazine that American scientific publication has 'flattened' in comparison with the proportions accounted for by rising scientific powers like China, South Korea and the EU; but not to worry, it is the foreigners who are getting better, not the Americans who are getting worse.

I am not absolutely certain that American scientific output is contracting, although there are plenty of reasons to suspect it, many of which I have not gone into tonight. What I *am* certain about is: if all the sources of data about the health of science have been privatized, controlled by for-profit corporations, and the data threatens to

cast the privatization of science in a bad or unflattering light, than it is inevitable that the firm and its clientele will find ways to mask, obscure and otherwise deny that anything untoward is happening. Growth is the heart and soul of the system of Globalized Privatization of science; all evidence that the system is not growing (whatever that means in the realm of science) must be hidden, denied, defined away, dispelled. Is your balance sheet loaded down with non-performing assets? Then just get the Lords of Accounting to redefine the accounting rules. Is your cash flow stream getting a bit dodgy? Then just reconfigure your contractual payment schemes to make it appear more cash has come in now, whether it was actually accrued or not. And after you have already played fast and loose with the meaning of knowledge to weather the gales of economic distress, then what is the harm in jiggering the evidence with regard to the privatization of science? This is the sense in which Thomson Reuters is engaging in a Ponzi scheme every bit as dangerous as the previous instances of the biotech firm and the technology transfer office.

3. Why Do the Science Ponzi Schemes Exist?

I fully expect many in my audience will greet what I have just said with affronted incredulity. Can we really be living in a world where failing business models are presented with a straight face as the next new new thing, where money-losing propositions are presented as get-rich quick schemes, where intellectual debility is trumpeted as health, and where the engrossment and hobbling of science are portrayed as its salvation? Actually this is a fascinating topic, one which itself requires a book, and cannot be done full justice here.

There are two quick and dirty responses to get you to chill your reflex revulsion to my thesis. The first is: Recall the world economic crisis we have all just lived through. Couldn't you pose those exact same questions there? Didn't it seem as outrageously unlikely to be true until Lehman bit the dust?

The second answer is a bit Machiavellian, but I do want my audience to at least entertain it briefly. It suggests that much of the move to commodify science is not really driven so much by the profit motive as it is by an ideological crusade. In *ScienceMart* and in a previous book of mine *The Road from Mont Pèlerin*, I present the history of the neoliberal ideas behind the commodification of knowledge. The First Commandment of

the Neoliberal Credo is that The Market is the unique superior information processor known to mankind, smarter than any individual human being, or any other social institution. Consequently the commercialization of knowledge is deemed by neoliberals identical with the march of civilization. One corollary of this belief is that we mere mortals can never know the truth of this First Commandment; we can only rely upon our faith in the market to invest it with Truth. I know this may sound circular, and perhaps absurd; but I would suggest that you read what the neoliberals have actually written.

A second corollary is that academic science, insofar it is sheltered from market forces, is not regarded by neoliberals as the highest achievement of mankind. Rather, state-supported science, like state supported universities, are the last vestige of socialism in the capitalist sphere, and need to be pared back to insignificance.³³ Recent fiscal crises are used as the public excuse to carry out the long sought dissolution of the universities into disaggregated for-profit units. Academics who don't comprehend the politics of the situation have become cannon fodder for the Neoliberal Revolution.

When economists who pride themselves in opposing neoliberalism like, for example, Paul David argue that the best way to defend the integrity of the modern university is to simply to calculate and impose the optimal mix of public and privately-funded science (David & Dasgupta, 1994), they play right into the hands of the neoliberals. One can sympathize when he argues,

For university administrators to encourage (or even permit) political leaders to entertain the hope that the energies of their faculties and students could be harnessed to yield accelerated productivity growth, showers of better-quality products, enlarged export earnings, and local job creation—all within the brief time frame that will make a difference in the coming elections – is not merely deceptive. It is quite reckless in risking the almost certain disappointment of unrealistic expectations, and so may bring in its train public disaffection and damage to the university. (2007b, p.263)

Yet sympathy turns to despair when we realize that he does not apparently notice two things: first, the provocation of disaffection of the public with their universities is *part of*

³³ It started out with the hostility of neoliberals like Milton Friedman and George Stigler to the state provision of higher education. Friedman devoted much of his accumulated fortune to the privatization of state supported education, which he regarded as the largest residual sector of state socialism in the West. Hayek famously disparaged academics as 'second-hand purveyors' of ideas.

the design of the entire neoliberal agenda; and secondly, that the neoliberal production of ignorance (in the sense of researchers telling patrons what they want to hear) drives a wedge between scientific research and economic growth, such that any promises of payoffs, however delayed and unpredictable, are no longer grounded in the academic system of research. The neoliberals are aware of that, but unperturbed; they don't want science to be funded based on any such reasoning. They look forward to the Rapturous day when all knowledge (and not just science) is comprehensively funded and coordinated by the market, which really means private corporations, and state-organized research is reduced to a pitiful insignificant remnant. Paul David, by making his benchmark some ideal marketplace of ideas, himself ends up undermining 'public' science in the name of subjecting it to a balanced optimization calculus. Pace Paul David, there is no longer any option to find that elusive optimal public/private mix in research and education, because the state system of higher education has been irreversibly privatized (Rizzo, 2004).