

# Advancing the Social Sciences through Interdisciplinary Collaborations

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**R**apid advances in virtually all other disciplines today are being propelled by inter-disciplinary collaborations. I will give some specific examples of successful collaborations in this category at MU. Moreover, I would like to emphasize the important advances that have occurred recently throughout the world through close collaborations between economists and physicists. This has resulted in a new sub-discipline called 'econophysics', which I discuss within the enclosed paper titled "Innovators, Regulators, and the Fate of Nations". In my opinion, this collaboration that has led to establishing 'econophysics' is of great value to society today, and that the proper understanding of risks in the marketplace is essential to the world's recovery from the current 'Great Recession'.

## **Collaborative Examples**

Case 1: Understanding perfect autobiographical memory: A collaboration between psychologists, neurologists, and brain imaging scientists:

About 20 people have been identified with perfect autobiographical memory. An understanding of the underlying reasons for this exceptional ability may prove useful, even revolutionary, in the study of how brain structure and dynamics influences human capability, and in how emotional stability is influenced, if at all, by the ability of people to forget prior experiences. The lead researcher in this emerging sub-discipline of study is Prof. James McGaugh of UC, Irvine. This has been featured on CBS 60 Minutes: <http://www.cbsnews.com/stories/2010/12/16/60minutes/main7156877.shtml>

Functional MRI brain imaging has shown that all known subjects with perfect autobiographical memory share cer-

tain unusual neurological traits: First, they all have a very large frontal lobe, which is no surprise, since the frontal lobe of the brain is associated with memory. Secondly, and less intuitively, these people have a very large caudate nucleus, which exists deep inside the brain. A large caudate nucleus has been associated with obsessive compulsive disorders, and in fact this behavior trait is observed to some degree in most of the subjects. Surprisingly, there is no clear correlation with emotional instability in these subjects. This is surprising since it has been thought that the ability to forget is an essential aspect of human emotional stability. Just the opposite is seen in these people with perfect autobiographical memory. They all have perfect recall of every event during their lives, and some even exhibit a strong emotional response when they are asked about traumatic events earlier in their lives, but there appears to be no strong

correlation with emotional instabilities within this small cohort.

While the reason for the development of perfect autobiographical memory is unknown at this time, it will likely be elucidated over the next few years of focused, inter-disciplinary research. Hypothetically, it appears that those with this trait may have an abundance of adrenaline present in their brains in a nearly continuous fashion. Most of us remember specific events because they are very traumatic, either in a positive or a negative way, and this trauma induces a surge of adrenaline immediately following the memorable event. It is thought that this surge in adrenaline may be precisely what causes the event that triggered the surge to be remembered in the long term. But again, this is a new sub-discipline that will motivate and challenge memory research, and other areas of neural psychology, for decades to come.

This emerging collaborative sub-discipline is a good example of how new technology is able to contribute to a well-established discipline, in this case psychology. This new technology provides an opportunity to challenge long-held beliefs with new data, resulting in a rapid expansion of the conventional discipline. The discovery of these exceptionally capable people with perfect autobiographical memories enriches and enhances our understanding of our neural diversity, and provides a new approach to understanding the natural wide scope of variations in the human condition. In turn, applications such as this provide new opportunities to advance functional brain imaging, not only through fMRI, but also through other

functional brain imaging modalities such as Positron Emission Tomography (PET) and Magneto-encephalographic Imaging (MEG) technologies. The structural and dynamic patterns that these brain imaging systems are optimized to detect depend, of course, on the nature of these patterns themselves, so advances in the understanding of neuroscience feed-back into improvements in the ability of available measurement technologies to detect the new structures and patterns of interest.

Case 2: Nuclear activation analysis and the MU Archaeometry Program. A collaboration between archeologists, anthropologists, and nuclear scientists and engineers:

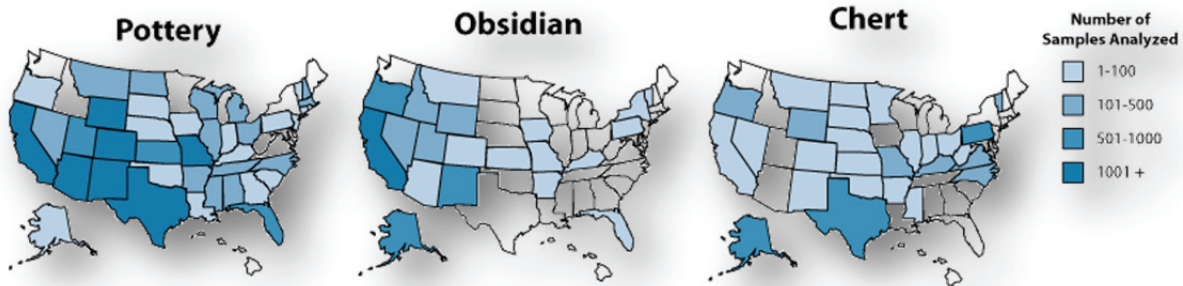
The MU Research Reactor Archaeometry Program analyzes many different artifacts from ancient indigenous populations. This powerful new technique can provide a valuable new source of data to test earlier thoughts, hypotheses, and assumptions regarding the movements of ancient populations, such as those for which there is only a limited record of their society and traditions. These techniques have helped determine, for example, not only which volcano produced the obsidian that was used to produce tools and weapons of the ancient civilization, but also which eruption of that volcano produce the lava flow that led to the obsidian. This helps reconstruct trade routes of ancient populations, and provides a deeper understanding of their mobility and their level of interactions with other civilizations. This vastly changes our understanding of how ancient civilizations interacted, traded, and moved nomadically. The MU Archaeometry Program has

analyzed over 100,000+ samples, as shown in the following graphic that may be found with much more detail at: <http://archaeometry.missouri.edu>

Many other technologies have been developed to advance our understanding of ancient civilizations and how they

in the systematic development of 'Econophysics':

The application of scaling and self-organized criticality (SOC) to the social sciences appears to be a rich area for interdisciplinary collaborations. Recently the Joint Chiefs of the US Department of



**Figure 1:** The number of samples analyzed by the MU Archaeometry Program. More details are available at: <http://archaeometry.missouri.edu>

interacted. The MU Archaeometry Program also used state-of-the art mass spectroscopy to perform stable isotope ratio analysis, and trace analysis, to supplement their inferences from trace nuclear activation analysis. These capabilities are strongly enabled by the large interdisciplinary activities at the MU Research Reactor (MURR), which employs over 160 people to staff a wide variety of activities. Furthermore, anthropologists throughout the world have availed themselves of advanced genetic sequencing technology that has been used to perform in depth analysis of the genetic variation and commonality of populations, which provides a powerful tool in discerning how early populations evolved and adapted to their environments, and how they evolved to produce future populations and societies.

Case 3: Applications of Complexity Theory to the Social Sciences, especially

Defense have added a new Special Advisor position for Complexity Research. While the applications of complexity theory have become somewhat of a trendy 'buzz-word' lately, none-the-less the development of complexity theory has been remarkably systematic, and its applications to the social sciences are profoundly enabling of our abilities to understand much more deeply the true nature of risk and benefit in these systems.

One profoundly successful application of complexity theory to the social sciences centered on the development of 'econophysics' by research groups at the Santa Fe Institute (Doyne Farmer), and at Boston University (Eugene Stanley). Many other groups throughout the world have joined this effort, and as early as 2004 the National Science Foundation, through their Consortium of the Americas for Interdisciplinary Science, sponsored a conference in SOC and its

applications to the social sciences in Brazil. There is a high likelihood that many of the social sciences will realize a surge in capability through the application of modern complexity theory within their disciplines.

I have prepared a paper entitled “Innovators, Regulators, and the Fate of Nations” that centered around how profoundly and counter-intuitively the development of econophysics has altered our understanding of the risk – benefit analysis that we perform, often inadvertently, in our everyday decision making. I posit that our misinterpretation of the likelihood of huge, catastrophic events has caused us to go out-of-balance in our applications of regulations and our encouragement of innovation, and that this has damaged society profoundly, and will likely continue to do so in the future. I prepared this paper as an after-dinner talk that I delivered on November 15, 2010, and I have slightly revised it to the form that appears in the Appendix to this paper. I intend to detail this concept in the future, and prepare a monograph on this topic when time permits.

### **Conclusions**

I have discussed the advancement of the social sciences through a few focused examples below. The social sciences, like almost all other disciplines, will benefit profoundly from the new

and creative thought, and the expansion of the scientific method rigorously, as technologies are developed to rapidly advance their cause. Of course there are opportunities as well for great advancements purely within each of the social sciences, but in this paper I have restricted myself to discuss collaborative, inter-disciplinary opportunities.

The advancement of all of our disciplines will depend largely on the expansion of resources available for our professional pursuits, and this in turn will require society to see and understand an expanding relevance of our work to the betterment of humanity. In my experience, fresh approaches that become ever more demanding on data-based inferences, and on the systematic development of knowledge through the Scientific Method, most rapidly prove this worth to society, and hence win their support. Such opportunities are also thrilling intellectually, since they almost always lead to unexpected discovery, and the elucidation of systems and processes that were at best poorly understood before. It is this spirit of discovery, coupled with the broader relevance of our work in the social sciences, which promises to reverse the current negative opinion trends, and provide a healthy advancement of these social science disciplines for many decades to come.

## Appendix: Excerpts from “Innovators, Regulators, and the Fate of Nations”

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Why do mighty institutions fail? A related question, centered on how mighty corporations fail, has been addressed in a very competent manner recently by Jim Collins in his book titled How the Mighty Fall. These common causes are not ‘scale invariant’. The collection of reasons for the failure of a single proprietor firm is considerably different than the collection of underlying reasons for the failure of hundred-billion dollar international corporations, although there do appear to be a few haunting similarities in these root-causes that may be associated with the personal traits of bravado, arrogance, and denial becoming manifest at a corporate ‘group think’ scale. But now let’s examine even larger scales, and address concerns that are so horrific that they generally go unspoken: Why do nations fail? Why do once thriving societies and their social philosophies suddenly disappear from the face of the earth? Are there underlying root causes that are either ubiquitous in the human condition, or, at the very least, manifest in universal emergent social behaviors? Let’s transcend obvious statements like ‘corporations fail for lack of proper cash flow’, or ‘governments fail when they lose the public’s trust’, since these statements, while true, do little more than acknowledge the obvious. Instead, let’s ask what aspects of our nature, and what universal logical errors in our reasoning, so often set us collectively as societies on what, without intervention, will lead to disaster.

Here I would like to suggest that these huge failures in nations occur because we enforce stiflingly rigid regulations where we should innovate, while simultaneously we innovate wildly where any practical, pragmatic society would insist on regulation instead. I propose that it is the wise balancing between regulation and innovation in any society that will determine if it continues to grow strong, or if it fails. I will give a few specific examples from history, and provide some non-mathematical insight into an underlying new scientific concept that has altered our fundamental understanding of risk management profoundly.

First, why would ‘hard-wired’ physicists try to address a question that would appear to be more appropriately fielded by our accomplished social scientists? Well, many mathematical physicists have been on this intellectual course for about three decades now, in the exploration of what is generally called ‘complexity theory’ which includes the recently popularized ‘chaos theory’. Complexity theory has accomplished at least two intellectual triumphs recently, in my opinion, namely the application of the Renormalization Group Theory to critical phenomena, which won Kenneth Wilson the 1980 Nobel Prize in Physics (which incidentally was the last Nobel Prize to be awarded unshared to a single physicist), and the pivotal development of the theory of Self-Organized Criticality (SOC) by Per Bak in 1988. These are also central to my

own areas of research, at a more humble level. Per Bak was a friend of mine, and a physicist who worked through his joint appointments at the University of Copenhagen and the Santa Fe Institute, and who sadly died at a young age. His work was so interesting and controversial that some of the more conventional physicists I know had hoped that SOC would die with him. But just the opposite has happened. SOC has eloquently resolved difficult-to-understand phenomena that have baffled physicists who study statistical process for centuries. The strange universal relationships between the size and frequency of almost everything, ranging from forest fires, earthquakes, hurricanes, even noise in electronic circuits, to name a few, have led to profound, unprecedented success-

may have heard of the popular book by Thomas Bass called The Predictors on this same subject. Bass' book, in my opinion, misses the intellectual essence of this thought revolution, since actually chaos theory predicts nothing about any particular individual outcome at all. In the context of this essay, I will discuss one profound application of SOC below that has become known as 'Econophysics', which has been pioneered by Professor Eugene Stanley of Boston University.

Econophysics has elucidated misconceptions in financial risk analysis that have cost investors literally billions of dollars in the past two decades alone. Sadly, these misconceptions created an industry of high-tech arbitrage hedge funds that have contributed wildly to

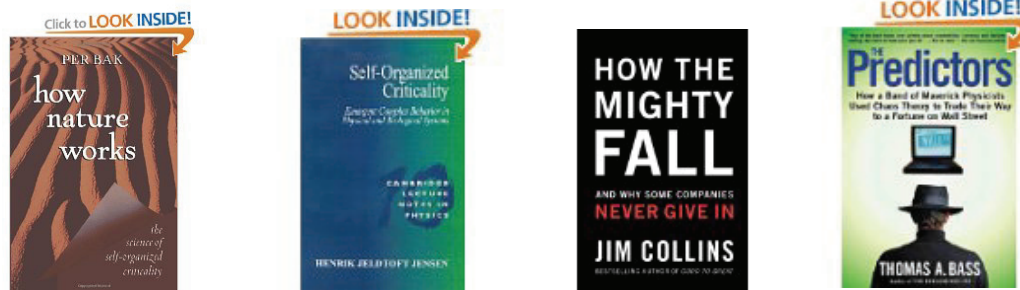


Figure 1: The four books that are referenced in this essay. All are readily available on-line.

es in how we accurately understand statistical inference in almost everything we do and encounter. A detailed description of SOC is off-topic for this essay, so I will refer those who are interested to Per Bak's book for the non-specialist entitled How Nature Works (Copernicus, 1996). For those who may want a more mathematical treatment of this theory, please see Henrik Jensen's book entitled Self Organized Criticality, which I have taught interdisciplinary graduate courses from in the past. You

the demise of our financial markets today. While I wish that I could say this new knowledge has put these dangerous practices out of business once and for all, that does not appear to be the case. Despite the recent near collapse of our financial markets, these option-based funds are reemerging today, with the same crazed persistence and defiance of reality that led initially to support for what I consider to be irresponsible mortgage lending recently within the American Recovery and Reinvestment

Act. Whether it is the unrealistic desire to get rich without producing any real value to society, or the determination of well-meaning politicians to create unattainable home ownership for everyone in the United States regardless of their level of income or demonstrated personal responsibility, compelling ideas persist that defy respect for the statistical variance across our populations, and which fly in the face of economic reality. This becomes a superb illustration of the first of two ubiquitous reasons why nations meet their ruin: They innovate wildly in situations where any reasonable value system would properly insist on regulation instead.

In 1994, two prominent Nobel Laureates in economics, named Robert Merton and Myron Scholes, joined with a legendary bond trader named John Meriwether to form a company called Long-Term Capital Management L.P., and they rapidly accumulated five billion dollars in operating assets for their company. They promised huge returns at effectively no risk, based upon their mathematical model of market fluctuations. We now realize from our new understanding of econophysics that this model was dangerously naïve. Long-Term Capital Management practiced fixed-income arbitrage trading, where they identified essentially identical assets that were selling at different prices in different market locations around the world. They would sell the more expensive asset short, while buying a long position on the undervalued asset. In so doing they were positioned to make substantial income without regard for the increase or decrease of the assets' price, just as long as the cost of the near-

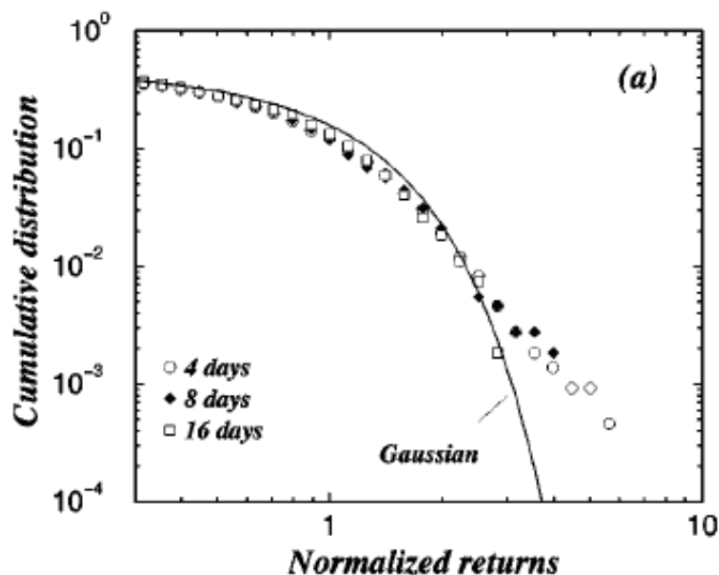
ly identical assets converged over time. Indeed, for their first four years they made an outstanding return, in excess of 40% per year. But suddenly in 1998 they lost over half of their assets, and ended operations with a huge loss in 2000. The business community found this shocking, the physicists found it fascinating, and the founders of the company claimed that they had experienced a market fluctuation of the likes of which should only have occurred once in 70,000 years! What was their big mistake? Well, they had assumed that the fluctuations of the markets could be described by a 'Gaussian' statistical distribution mathematically, which would have been correct only if all stock and commodity traders functioned as entirely independent actors on the world's financial stage. But that is certainly not how traders operate. Instead they follow each other's leads spontaneously and so tightly that the leader often at the time has no idea that he or she is actually leading! These tightly oriented trading relationships occur at all scales from big to small, and they dynamically redefine themselves in absolutely unpredictable ways, creating an operational definition of chaos. Traders follow each other's leads much in the same way as birds flock or bees swarm. Modern electronic trading modalities further lock trading strategies together in complex ways that the individual investors themselves don't understand. This is clearly not consistent with the independent trader model that is at the basis of a Gaussian distribution of market fluctuations, and which was at the heart of classical financial stability theory until the late 1990s.

In a nutshell, the problem with Long-Term Capital Management L.P. was that all classical financial stability theory up until 1998 was based implicitly upon these 'independent trader' models, which resulted in Gaussian statistical distributions that attempted to predict the probability of market fluctuations. Conceptually, without jumping deeply into the mathematics, correlated trades vastly increase the risk of catastrophic failure, but it is uncanny that much smaller fluctuations that happen often are none-the-less well described by conventional Gaussian distributions. Only about two in a hundred fluctuations are expected to be larger than two standard deviations from the mean according to Gaussian statistics, and this is true in highly correlated markets as well. So, if your comparison of your risk model to actual observed market fluctuations only consider common fluctuations, and never tries to understand the really rare large ones, then you will be misled into thinking that the Gaussian distribution works well, just as the Nobel Laureates in Long-Term Capital Management L.P. did. But in highly correlated markets the probability of very rare market fluctuations, such as fluctuations that fall more than three standard deviations from the mean, are vastly more common than a Gaussian distribution would suggest. Highly correlated trades produce large fluctuations that are governed by power law distributions called Levy distributions, and these fall off toward zero probability much more slowly than does the Gaussian distribution. I like the following analogy: If buffalo stampeded independently, that is if they ran around at a gallop while they completely ig-

nored each other, then there would be a Gaussian probability that occasionally a few less competent buffalo would not see the cliff in time to avoid charging off it, but by and large the herd would not be at any catastrophic risk of extinction due to the cliff. But in real life, stampedes are highly correlated, with buffalos blindly following each other's leads in rapidly changing, chaotic ways. If the inadvertent lead buffalo charges off the cliff accidentally, then there is a good chance that the entire herd will do the same, creating a catastrophic event that could end the existence of the entire herd.

In order to understand the true fluctuation distributions in financial markets, Eugene Stanley obtained the time series of over 1.5 million fluctuations in the Standard and Poor's financial index to develop a probability distribution of market fluctuations over various time scales. He has subsequently done similar analyses of other market indices throughout the world, and for individual stocks in particular markets. The generalized probability distribution that he observed in the S&P index fluctuations is displayed in the figure below. Notice that fluctuations within two or three standard deviations from the mean are well modeled by a Gaussian distribution, but that much larger fluctuations are far more common than a Gaussian distribution would predict. When this sort of analysis was applied to the Meriwether hedge fund's operation, their 'once in 70,000 year' fluctuation, as inappropriately modeled with a Gaussian distribution, would have been expected to occur in less than five years, and in fact it did. Many people lost some or all





**Figure 2:** Data on the observed fluctuation probability of the S&P index, using over one million observed fluctuations of the actual index on various time scales. From “Scaling of the distribution of fluctuations of financial market indices”, by Parameswaran Gopikrishnan, Vasiliki Plerou, Lu’s A. Nunes Amaral, Martin Meyer, and H. Eugene Stanley (Physical Review E **60**, 5305 (1999)). Notice that the probability of a fluctuation occurring at two standard deviations from the mean (approximately normalized returns = 2) is about one in 19, in good agreement with the Gaussian prediction. The probability of a fluctuation that is three standard deviations from the mean is predicted to occur about once in 225 per the Gaussian distribution, which agrees fairly well with reality. But the probability of a fluctuation at six standard deviations from the mean is predicted to be one in 165 million per the Gaussian distribution, while this actual S&P analysis suggests it will happen far more frequently, at about one time in 2,000. Hence, the probability of huge ‘catastrophic’ fluctuations is vastly larger in highly correlated systems such as market trading than a Gaussian distribution would predict.

of their retirement accounts and their life savings as a result of this big philosophical and hence mathematical misunderstanding. While I was the Gordon and Betty Moore Distinguished Scholar at Caltech in 2004 I was working with some of the world’s leading physicists as we successfully applied SOC to understand anomalous heat transport near the superfluid transition in helium. Two years earlier, one of the brightest students I know from Caltech completed his Ph.D. under the advisement of a theoretical physics professor with whom I have collaborated for many years. This student was hired by a very wealthy firm in New York City to apply many of these econophysics-related techniques to properly price derivative trades based upon what had been learned following the gruesome 1998 failure described above. With the advent of very sophisti-

cated electronic trading since that time, as well as new, wildly complex arbitrage fund strategies, theoretical techniques based on econophysics predict an absolute instability that results from an infinite standard deviation in the realistic probability function for market fluctuations. None-the-less, by the time that the economies of the United States, and in fact the economies of most of the world, nearly failed in 2008, economists estimated that over 20 trillion dollars of so-called market value was tied up in derivative financial instruments, including options! Please realize that most of this 20 trillion dollars was associated only with the value of option bets, and hence, was in no way associated with any real production of goods or services. Sadly, it appears that we did not learn anything from the terrible failure of Long-Term Capital Management L.P. a decade earli-

er! Worse yet, a substantial portion of our perceived market rebound today is actually associated with growth in arbitrage fund values, and hence in new and more sophisticated option-based instruments. Regardless of how you dress up an option, it is still nothing more than a bet. Options were invented honestly enough as a hedge against risk, but they went malignant, and they now threaten the survival of our markets. Computers can generate thousands of these option-based bets per second, and each can be assigned a cash value, now using these complex tools that we have learned using econophysics. As the economy expands again, people are actually buying option-based securities for retirement accounts and other funds that they manage. This is a simple example of improper value being generated from vapor, and it threatens to continue to produce an ever increasing cascade of disasters in our economy until all financial systems throughout the world are left in ruin.

Why do we permit such wild innovation from some of our best mathematical minds of our time in our financial markets, where any sane system would require regulation instead to protect the accumulated value of our citizen's life savings and retirement accounts? By and large these option trades do not help produce and trade goods and services, which is what we established financial markets to do in the first place. They simply are bets. Why aren't these outstanding intellects joining with others who are currently striving to cure cancer, to solve the world's energy problems, and in other essential pursuits? I am not opposed to honest option trading, but let's be realistic and not consider

them in any way to be securities. Imagine how much healthier we would be if we honestly treated options as bets, and only permitted them to be sold in a manner that is consistent with gaming laws in states where gambling is both regulated and legal. This would also emphasize that our markets are to be used in a manner that is consistent with the growth of a healthy economy, and not as a playground for sophisticated tricksters to try to squeeze money out of inefficiencies in the mechanics of the trading operations. This, and proper financial management of margin trading accounts, could prevent future market crashes that very likely will be far more severe than those that we have experienced already. Proper regulation of these options would put our best minds back to work on innovations that create value for society and improve the human condition overall.

Unfortunately, it is all too easy to find examples of the second component that I posit threatens national survival, namely that we inappropriately impose daunting regulations in situations that suppress real creativity, when actually we should encourage innovation instead. Just look at modern research universities across the United States today. These centers that are dedicated to the advancement of knowledge are persistently being scrutinized through public regulations to assure that no value that they may someday create is in anyway developed in such a manner that it unfairly benefits one group over another. The rate at which new regulations are being heaped on everything from conflict of interest rules to export restrictions, and everything in between, is

staggering, and these practices are vastly slowing the rate at which our knowledge-based economy can recover today. Please understand that I am all in favor of proper operations of university research and intellectual property commercialization, but I suspect that the extreme emphasis and expense associated with policing these essential university functions is inconsistent with a rational, evidence-based assignment of resources in academia today. I estimate that only about 0.2% of all federal funds to universities are misappropriated, on the basis that this is about equal to the disallowed charges that are returned by universities to the federal government as a result of audit findings. I would suggest that a little less federal regulation of university research, and a little more federal regulation of the options markets discussed above, could have saved humanity a lot of lost value during the financial failures that started in October of 2008. We at MU have tracked how much effort we have had to spend on new unfunded mandates on research over the last two years, since new regulations on research, many of which are associated with the American Recovery and Reinvestment Act (ARRA), went into effect. This has come to about 1,200 hours of effort at MU without any opportunity to recover these labor costs from the government agencies that requires this labor from us. By the way, only 2% of the nearly one trillion dollars that have been spent under the ARRA has been spent on university research, but when the public's displeasure with the results of ARRA surged, the media did nothing but discuss what they considered to be wasteful spending on university re-

search from these funds. This is in part true since it is very easy to wildly simplify new innovations, and thereby make innovators look foolish. If the efforts by universities and businesses to innovate and to produce new value for our economy through discovery continues to be unfairly and disproportionately hounded by federal regulators and by the press, then the reemergence of our former standard of living will be stifled for many years to come.

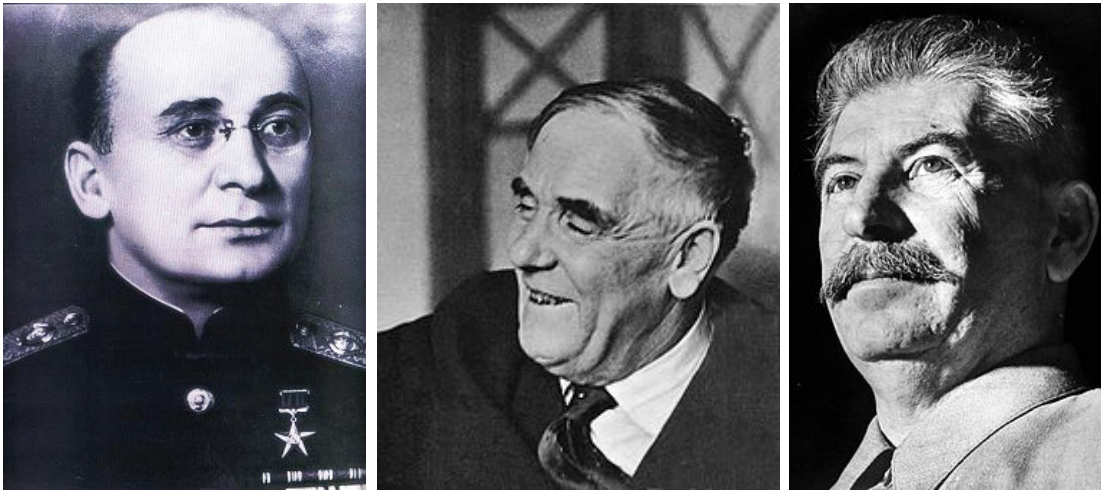
As C.D. Mote, the outgoing Chancellor of the University of Maryland put it, for every one engineering-ready degree that was awarded in the United States in 2007 there were 25 law degrees and 50 MBAs awarded. Our inattention as a society to the Science, Technology, Engineering and Math (STEM) disciplines has led us to produce regulators from our own citizens at an astounding rate, while producing very few innovators. Hence, predictably, most of the business community in the United States today knows how to regulate well, but is generally losing touch of their knowledge of how to innovate. Of course business and law are very important disciplines, but we have over-checked this box at the expense of our technical creativity. Simply put, we have gone from being a wonderfully successful Nation of innovators to a failing Nation of regulators over the last three generations. The vast majority of our science and engineering students in the United States today are from foreign countries, and our best engineering faculty members at MU are routinely limited on their sensitive, government-funded projects by their inability to attract graduate students who are U.S. Citizens to help them

perform the work. At the same time, this base of international graduate students who matriculate to U.S. universities to advance non-sensitive, basic science is falling off rapidly today, as the U.S. loses its luster as the best place in the world for personal career advancement. This is even more disturbing, since many of the top business and public leaders in the U.S. today had immigrated here for university study. As we lose this luster that has historically attracted the best and brightest students from around the world, we lose our future prosperity.

There is another effect as well: Academia, and innovative companies, attempt to spend their time and resources on innovation, and hence are less prepared to defend themselves against those who seek to assign blame when the public becomes angry over their declining quality of life. Hence those who have to appear to generate a solution that addresses short-term public concerns through regulation are much more likely to disproportionately try to blame the innovators for the failure of society, thereby compounding the problem. These effects conspire to create an environment where real technical innovation and creativity, which is essential to our national recovery, is forced off-shore instead.

I won a major foundation grant a few years ago, which provided me the opportunity to collaborate closely with Academician Alexander Andreev, Vice President of the Russian Academy of

Sciences, and hence to travel back and forth to Moscow many times from 1998 to 2004, during which time I learned a lot about the long-enduring conflict between innovators and regulators in Russia. I would like to suggest that it was the failure of the former Soviet Union to innovate at the beginning of the nuclear age that ultimately resulted in the downfall of this nation that was once a formidable superpower. Suffice it to say that when Joseph Stalin backed a recommendation by Lavertiy Beria, then the ruthless head of the Soviet Secret Police, to simply steal and copy U.S. weapon designs, over physicist Piotr Kapitza's urging that they design better weapons instead, the demise of the former Soviet Union was just a matter of time. Hence, during the critical first ten years of the Cold War, we in the United States were quite specifically familiar with the design limitations of the Soviet arsenal, since it was simply copied from us, so we knew precisely what their threat consisted of and how to defeat it. Beria's victory with Stalin over Kapitza's objections, in my opinion, set the Soviet Union on a philosophical course that strongly preferred regulation over innovation, and ultimately resulted in their demise. History is rife with many other examples of how nations have failed due to their refusal to be innovative at critical times in their national progression. Sadly, and in my opinion, the United States is currently on a clear course to suffer a similar fate today.



**Figure 3:** Beria, the ruthless head of the Soviet Secret Police, Nobel-prize winning physicist and Academician Kapitza, and Soviet Party Chairman Stalin. The details of this classic conflict between Regulator and Innovator are as fascinating as they are horrific.

Fortunately we in the United States are excellent at making major course corrections rapidly, and it is of the utmost importance that we start to do so now. We must stop innovating new methods of trade in our financial markets that serve only to try to extract wealth with no real production of value to society, with no increase in our quality of life, and with no real commercial output of goods and services. Instead, we have to return to a respect for, and a dedication to protect, our wealth management structures in the USA that contain the retirement accounts of our citizens. We must start genuinely innovating new and creative products and services again, against the huge opposition

of an expanding federal government that knows almost nothing more than how to put our citizens to work as regulators. Regulators and innovators naturally distrust each other, but now is the time to have both of these essential elements respect each other, with a common focus on increasing real national output. In my opinion, it is of paramount importance for the United States to come back into the proper balance between regulation and innovation as needed to see our wonderful and egalitarian Country, with liberty and justice for all, prosper again, and thereby assure its continuation for centuries to come. The alternative is simply unthinkable.