

Economic Security and National Security

Interaction and Synthesis

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NATIONAL SECURITY has never been more captive to economic security than it is today. Economic security is not restricted to the usual fluctuations in gross domestic product (GDP), employment, productivity, and other metrics which have been the focus of macroeconomists for decades and still predominate in academic studies. Analysis of trends in GDP—such as the rise of China, decline or instability in Russia, and the outlook for the United States—while important, do not by themselves pose immediate challenges to US national security. Instead, in the present context, economic security refers to global capital flows and the capital and commodities markets which accommodate those flows. Through these channels currencies can be destroyed, inflation can be transmitted, reserves can be depleted, and financial institutions can be destabilized.

In the extreme, entire sections of global capital markets can be frozen and debilitated to the detriment of those who rely on them most; in particular, the United States. Central bankers, finance ministers, and treasury secretaries speak glibly about systemic risk while rarely stopping to think about what they mean by the word *system*, which is at the root of *systemic*. They have a concept of the system of money, banking, and the institutions that conduct those operations which create money and extend credit, which connects directly to macroeconomic theories expressed variously as Keynesian or Monetarist. This understanding translates into misnamed stimulus packages which are, in fact, redistributionist inflation packages to be carried out by Treasury borrowing and Federal Reserve monetization

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of the resulting debt.¹ The circularity of this superficial understanding of system and the ineffectuality of macroeconomics in a systemic crisis is thus complete.

Providing true economic security requires an analysis of the economic system through the binocular lenses of physics and engineering with an approach called *econophysics*. This approach studies the following questions: Are global capital markets a system? If yes, is it a static or dynamic system? If dynamic, is it a linear or nonlinear dynamic? If a nonlinear dynamic, what are the emergent properties of nonlinearity? Is the system scale-invariant? What are the appropriate metrics for normalizing and parameterizing the scale? Does it represent an example of self-organized criticality? What are the boundaries of systemic-phase transitions?

The studies of these and other questions are the keys to understanding expected behavior and appropriate public policy in the face of the ongoing global financial collapse. A proper understanding of global capital markets behavior is furthermore the key to understanding the vulnerabilities of the United States and other national participants. This allows for defensive and counterintelligence measures and offensive capability, where necessary—all under the heading of weaponized money.

In addition to this macro approach to geopolitical-economic strategy, there is a micro element involving particular companies, technologies, and sectors which are vulnerable to disguised control techniques intended to facilitate industrial and technological espionage, technology transfer, or the disabling of critical infrastructures.

Capital Markets as Complex Dynamic Systems— Econophysics

Over the past 50 years, financial economics has specialized in quantitative analysis of problems of asset pricing, asset allocation, and risk management. Its contributions have been voluminous, leading to the creation of derivative products and the enormous expansion of the markets in which those products are traded. Underlying these developments are two hypotheses: (1) The Efficient Market Hypothesis states that all available information is fully and rationally incorporated into market prices, which move from one level to another based on new information without reference to the past; therefore, no individual analysis can outperform the market, since all insights are effectively priced in already. (2) A Gaussian Hypothesis assumes a normal

distribution of price movements such that small fluctuations are common and extreme events are proportionately rare, with the overall degree distribution of such events falling within the familiar bell-curve shape associated with random phenomena.² These hypotheses were combined into a General Equilibrium Paradigm based upon mean reversion.

The empirical failures of the General Equilibrium Paradigm are well known. Consider the 19 October 1987 stock market crash in which the market fell 22.6 percent in one day; the December 1994 Tequila Crisis in which the Mexican peso fell 85 percent in one week; the September 1998 Russian-LTCM crisis in which capital markets almost ceased to function; the March 2000 dot-com collapse during which the NASDAQ fell 80 percent over 30 months; and the 9/11 attacks in which the New York Stock Exchange (NYSE) initially closed and then fell 14.3 percent in the week following its reopening. Of course, to this list of extreme events must now be added the financial crisis that began in July 2007. Events of this extreme magnitude should, according to the General Equilibrium Paradigm, either not happen at all (because rational buyers will seek bargains once valuations deviate beyond a certain magnitude) or happen perhaps once every 100 years (because standard deviations of this degree lie extremely close to the x -axis on the bell curve, which corresponds to a value close to zero on the y -axis, i.e., an extremely low-frequency event). The fact that all of these extreme events took place in just over 20 years is completely at odds with the predictions of stochastic methodology in a normally distributed paradigm.

Practitioners treated these observations not as fatal flaws in the General Equilibrium Paradigm but rather as anomalies to be explained away within the framework of the paradigm. Thus was born the “fat tail,” which is applied as an embellishment on the bell curve such that after approaching the x -axis (i.e., the extreme low-frequency region), the curve turns upward again to intersect data points representing a cluster of highly extreme but not so highly rare events. No explanation is given for what causes such events; it is simply a matter of fitting the curve to the data (or ignoring the data) and moving on without disturbing the paradigm.³ A better approach would have been to ask the question: If a normal distribution has a fat tail, is it really a normal distribution?⁴

Many critics, notably Nassim Taleb in his book *The Black Swan*, have made the point that analytics based on normal distributions do not accurately describe market behavior in many instances.⁵ However,

while these critics have been incisive and correct on the deficiencies of the normal distribution, they have not provided a new and analytically rigorous paradigm to replace it.⁶ It is not enough to overthrow an intellectual paradigm without offering a useful replacement. Indeed, risk managers could almost be excused for continuing to use the current deeply flawed methodology in the absence of anything with which to replace it.

A Gaussian distribution is not the only possible degree distribution. One of the most common distributions in nature—which accurately describes many phenomena—is the power law, which shows that the severity of an event is inversely proportional to its frequency with the proportionality expressed as an exponent. When graphed on a double logarithmic scale, the power law describing financial markets' risk is a straight line sloping downward from left to right; the negative exponent is the slope of the line.

This difference is not merely academic. Gaussian and power law distributions describe two *entirely different phenomena*. Power laws accurately describe a class of phenomena known as nonlinear dynamical systems which exhibit scale invariance; that is, orderly patterns are repeated at all scales. What is often taken for randomness at a given scale actually produces order (albeit chaotic, i.e., unpredictably deterministic) across scales.

The field of nonlinear dynamical systems was enriched in the 1990s by the concept of self-organized criticality.⁷ The idea is that actions propagate throughout systems in a *critical* chain reaction. In the critical state, the probability that an action will propagate is roughly balanced by the probability that the original action will dissipate. In the subcritical state, the probability of extensive effects from the initial action is low. In the supercritical state, a single minor action can lead to a catastrophic collapse. Such states have long been observed in physical systems such as nuclear chain reactions in uranium piles, where a small amount of uranium is relatively harmless (subcritical), and larger amounts can either be carefully controlled to produce desired energy (critical) or shaped to produce atomic explosions (supercritical).

The theory of financial markets existing in a critical state cannot be tested in a laboratory or particle accelerator in the same fashion as theories of atomic physics.⁸ Instead, the conclusion that financial markets are a critical system rests on two nonexperimental bases: one deductive, one inductive. The deductive basis is the ubiquity of power laws as an explanation for the behavior of a wide variety of complex systems in natural and social sciences, such as earthquakes, forest fires, sunspots, polarity,

drought, epidemiology, population dynamics, sizes of cities, wealth distribution, and so forth.⁹ This is all part of a more general movement in many natural and social sciences from nineteenth- and early twentieth-century equilibrium models to nonequilibrium models; this trend has now caught up with financial economics.

The inductive basis is the large variety of capital market behaviors, which has been empirically observed to fit well with the Nonlinear Paradigm.¹⁰ It is certainly more robust than the General Equilibrium Paradigm when it comes to explaining the extreme market movements described above. It is consistent with the fact that extreme events are not necessarily attributable to extreme causes but may arise spontaneously in the same initial conditions from routine causes. Experts who have pondered why the stock market fell almost 23 percent in a single day in 1987 have tried to retrofit various explanations, with culprits ranging from a dispute with Germany on currency values to the rise of portfolio insurance. Similarly, experts have queried why in 1998 the hedge fund LTCM lost \$4 billion in four weeks and nearly caused a systemic collapse, while in 2006 another hedge fund, Amaranth, lost \$6 billion in one week yet barely caused a ripple in financial markets. The answer in both cases is that there is no *linear* cause-and-effect relationship, and the search for differentiating proximate causes is futile. What does matter is that in all three cases, the system was in a critical state, but only in two (1987 and 1998) did initial conditions cause market losses to propagate into a full-scale panic, whereas in the other case (2006) such propagation did not occur; it died out. This is exactly the kind of unpredictable but potentially catastrophic behavior that the Nonlinear Paradigm anticipates.

In addition to these extreme events, research has shown that movements in stock prices adhere to the kind of discontinuous, scale-invariant behavior that the Nonlinear Paradigm describes.¹¹ In other words, the deep structure of financial markets is self-similar and chaotic at every scale. What is important for our purposes is to understand those emergent properties of nonlinear systems that have the most relevance for an analysis of the deep structure of financial markets. These properties include:

- Such systems are subject to sudden sharp collapses known as discontinuities.
- The severity of such collapses is inversely proportional to the frequency, (e.g., one event of size 1,000 for every 1,000 events of size

one); however, the extreme events happen with greater frequency than expected in a Gaussian distribution.

- A power law distribution allows events of all sizes with some frequency limited only by the scale of the system in which they occur.
- Events are scale-invariant; that is, large events are just bigger versions of small events and are not otherwise qualitatively different. This is important because the implication is that either small or large events may be caused by the same initial action, rather like minor or major forest fires possibly being caused by the same carelessly thrown match.
- Complexity is correlative with unpredictability.

While extreme events occur with much greater than normal frequency in nonlinear critical-state systems, these events are nevertheless limited by the scale of the system itself. If the financial system is a self-organized critical system, as both empirical evidence and deductive logic strongly suggest, the single most important question from a national security perspective is: What is the scale of the system? Simply put, the larger the scale of the system, the greater the potential collapse with correlative macroeconomic and other real-world effects.

The news on this front is daunting. There is no normalized scale similar to the Richter scale for measuring the size of markets or the size of disruptive events that occur within them; however, a few examples will make the point. According to recent estimates prepared by the McKinsey Global Institute, the ratio of world financial assets to world GDP grew from 100 percent in 1980 to 200 percent in 1993 to 316 percent in 2005. Over the same period, the absolute level of global financial assets increased from \$12 trillion to \$140 trillion and is projected to increase to \$240 trillion by 2010. The drivers of this exponential increase in scale are globalization, derivative products, and leverage.

Globalization in this context is the integration of capital markets across national boundaries. Until recently, there were specific laws and practices that had the effect of fragmenting capital markets into local or national venues with little interaction. These factors included withholding taxes, capital controls, protectionism, nonconvertible currencies, and licensing, regulatory, and other restrictions that tilted the playing field in favor of local champions and elites. All of these impediments have been removed

over the past 20 years to the point that the largest stock exchanges in the United States and Europe (the NYSE and Euronext) now operate as a single entity.

Derivative products have exhibited even faster growth than the growth in underlying financial assets. This stems from improved technology in the structuring, pricing, and trading of such instruments and the fact that the size of the derivatives market is not limited by the physical supply of any stock or commodity but may theoretically achieve *any* size, since the underlying instrument is notional rather than actual. The total notional value of all swaps increased from \$106 trillion to \$531 trillion between 2002 and 2006. The notional value of equity derivatives increased from \$2.5 trillion to \$11.9 trillion over the same period, while the notional value of credit default swaps increased from \$2.2 trillion to \$54.6 trillion.¹²

Leverage is the third element supporting the massive scaling of financial markets; margin debt of US brokerage firms has more than doubled from \$134.58 billion to \$293.2 billion from 2002 to 2007 while the amount of total assets per dollar of equity at major US brokerage firms has increased from approximately \$20 to \$26 in the same period. In addition, leveraged investors invest in other entities that use leverage to make still further investments. This type of layered leverage is impossible to unwind in a panic.

There can be no doubt that capital markets are larger and more complex than ever before. In a dynamically complex critical system, this means that the size of the maximum possible catastrophe is *exponentially* greater than ever. Recalling that systems described by a power law allow events of all sizes and that such events can occur at any time, particularly when the system is supercritical, the conclusion is inescapable that the greatest financial catastrophe in history is not only inevitable but could well be what we are experiencing today.

The more advanced risk practitioners have long recognized the shortcomings of using historical data in a normally distributed paradigm to compute risk measured in standard deviations from the norm. This is why they have added stress testing as an alternative or blended factor in their models. Such stress testing rests on historically extreme events, such as the market reaction to 9/11 or the stock market crash of 1987. However, this methodology has its flaws, since the worst outcomes in a dynamically complex critical-state system are not bounded by history but are only bounded by the scale of the system itself. Since the system is larger than ever, there is nothing in historical experience that provides a guide to the

size of the largest catastrophe that can arise today. The fact that the financial crisis which began in July 2007 has lasted longer, caused greater losses, and been more widespread, both geographically and sectorally, than most analysts predicted or can explain is a function of the vastly greater scale of the financial system which produces an exponentially greater catastrophe than has ever occurred before. This is why the past is not a guide and why the current crisis may be expected to produce results not unlike the Great Depression of 1929–41.

How could an enemy of the United States insinuate itself into financial markets to become a trusted counterparty with access to credit and transactional venues? Could such an adversary use that access to create imbalances which would branch and cascade through critical nodes in such a way as to cause panic, failure, and collapse?¹³ The ideal commercial cover for an enemy assault on financial markets would be an institution large enough to deploy massive amounts of capital and obtain large lines of credit but unregulated enough not to pose significant barriers to entry or be subject to oversight.

The hedge fund is the platform of choice for missions of this kind. Hedge funds are organized in tax-free, offshore jurisdictions such as the Cayman Islands, and are lightly regulated and highly secretive. Hedge funds are large enough customers to be given preferred access to clearing brokers and institutional trading systems and are offered generous credit terms that allow extensive leverage. The Chinese or Russian governments or al-Qaeda (with the backing of wealthy Salafists) could easily establish 10 such funds with \$100 million of capital each. The hedge funds would be geographically dispersed (e.g., Hong Kong, Geneva, Dubai, London, Zurich, New York, etc.). Using its \$100 million in capital, each fund could easily leverage using off-balance-sheet derivatives to a ratio of 100:1, which equals \$10 billion per fund or \$100 billion of trading positions in toto.

On orders from the foreign government or nonstate actor, the funds could simultaneously swarm global systems with one-sided sell orders on a popular index (such as the S&P 500 index future) or selected popular stocks (say, Google or Apple). Options or futures could be used to maximize leverage. The attack could commence in the off hours so that markets become illiquid and easily affected by the swarm attack. Using minimum financial force initially would ensure that ample reserves were available to continue if market forces attempted to equilibrate. The attack could accelerate throughout the day. The orders could be spread among

many brokers and clearing systems so that no single node would have a good handle on what was happening. Electronic execution could be used to the extent possible for the same reason; however, some human contact in the execution would be desirable to spread rumors. The stage is now set for panic.

If all the facts were known and if the market reacted in a perfectly rational way, supported by central banks willing to lend freely, equilibrium could assert itself and markets could absorb such selling. The problem is that all of the facts are not known, markets do not react rationally, and central banks suffer a lack of information. The attackers' strategy would rely on a panicked reaction which amplifies the initial attack and feeds on itself. Such catastrophes can only be averted by collective action, usually organized by central banks. Such rescues only work if there is enough of both information and time. The job of the enemy is therefore to move quickly, mask true intentions, and create as much disinformation and confusion as possible.

Why would nations with large dollar-denominated reserves and a major stake in the stability of the Western financial system, such as China or Russia, undertake such an attack? The history of warfare is full of strategic miscalculations in which parties initiated attacks seemingly against their own best interests or in situations where they were highly unlikely to gain or be victorious. Such miscalculations often stem from an overemphasis on short-term gains (such as unification of Taiwan with China or, in the case of Russia, handicapping a Western system with which it cannot hope to compete), to the exclusion of rational long-term calculus of costs and benefits. In any case, an attack on financial markets is unlikely to proceed in total isolation and is far more likely to be part of a multifaceted assault, possibly including an energy shut-off to Europe (in the case of Russia) or an invasion of Taiwan (in the case of China). Of course, in the case of al-Qaeda, the damage inflicted by an attack would be an end in itself.

Would such an attack succeed? Even massive financial resources marshaled by an enemy are not sufficient to destroy markets; this requires fuel added to the fire by panicked and unwitting investors. The panic could spread from node to node in an accelerating cascade of financial pressure exactly the way a power grid collapses when power surging from a failed section overwhelms an adjacent section causing it to fail also and so on. Strategically, the issue is not whether an attack would succeed (although it may well) but that it could succeed. We know the financial system is more

likely supercritical than critical because of past bailouts and massive scaling. We know that supercritical systems are highly susceptible to extreme events. We know that the maximum possible catastrophe is exponentially greater than anything we have experienced before because of this massive scaling. Also, the costs of the attack are miniscule. The actual investment by the enemy as described above is only \$1 billion, far less than the cost of a single naval vessel. There is even an element of plausible deniability; after a day of havoc the enemy hedge fund traders could simply disappear, leaving unwitting employees to clean up.

If the enemies fail they have a modest cost and some deniability; if they succeed they could destroy Western capital markets. This is an excellent risk-reward ratio.

Therefore, the enemy does not actually have to launch an attack to gain significant advantage. Strategically, we are back to Cold War theories of deterrence and applications of game theory. An enemy in a credible position to destroy Western capital markets need only threaten to do so to have the desired impact on policy makers.

For an enemy that cannot match the United States on land, sea, or air, the temptation to fight in the financial markets is great. Our financial markets are more vulnerable than ever, the methods for attacking them are easy and inexpensive, and the returns to the enemy in terms of the destruction of wealth and confidence are inestimable. It is imprudent to take this threat lightly or to ignore it. There will be no time to prepare once financial warfare commences.¹⁴

Techniques for Disguised Acquisition and Control

In broad terms, methods of corporate control or market manipulation potentially employed by adversaries may be grouped into direct and indirect methods. Direct methods are those used openly and in a manner typical of institutional investors but which could nevertheless have some malign purpose. Indirect methods are those where the structure of the transaction itself is designed to achieve some element of stealth or deception in furtherance of the malign intent. Direct methods of investment include, for example, the straightforward purchase or sale of financial instruments (stocks, bonds, partnership interests, etc.), whereas indirect methods may involve synthetic structures, front companies, and conduits.

Apart from enumerating the **direct methods** of investing—outright purchases of stocks and bonds—there might not appear to be much to say on this subject. But given the complexity and sophistication of modern financial engineering and investment banking, there is often far more to a share or a note than appears from the morning headlines. While conventional fixed-income and equity investments are stores of wealth (similar to money in some ways) and are traded on exchanges and governed by specialized commercial codes, they are nevertheless contracts between issuer and investor and, as such, are subject to the negotiation and customization which go into any contract. Because of the attractiveness of liquidity which an adversary might offer (especially at a time of global credit crisis) and the superior bargaining power of such adversaries, they are not always confined to fungible or standardized issues of shares of the type traded by ordinary investors on exchanges but may involve special issues (sometimes called private placements) with extensively customized terms.

Such complex negotiated terms can leave the adversary investor at a considerable advantage to the average investor in publicly traded shares. While these advantages are not commercially unreasonable, taking into account the superior liquidity and large size these adversaries offer to issuers, they can serve to entrench adversary ownership, provide material informational advantages, and limit the freedom of action of the issuer on a going forward basis. Observer status in board meetings provides all of the benefits of material nonpublic information without the burdens of director diligence and legal liability. Trainee programs likewise can be used as a privileged information channel and technology transfer program from the target company to the adversary. Such programs are not necessarily nefarious. They may simply be the price that issuers pay for ready access to the very large liquidity pools which adversaries offer in times of financial stress. However, to the extent these and other provisions can piggyback on what otherwise appears to be straightforward securities issuance, they deserve scrutiny and should be evaluated in the context of national security concerns.

The ways adversaries may seek to influence the conduct and management of sensitive target companies extend well beyond the voting rights and board seats typically examined in the national security context. While technical expertise is typically mobilized to consider the technology, intellectual property, and influence on critical infrastructure of target companies, it is not as clear that legal resources are routinely employed by the intelligence, military, and national security communities

to deconstruct governing documents and weigh the implications of options, covenants, rights, privileges, informational advantage, and other embedded features of equity, fixed-income, and hybrid issuance agreements. These issues deserve further consideration, particularly in the context of adversaries that command superior bargaining power and legal resources compared to other potential buyers of securities.

Indirect methods of investment are far more numerous, more complex, and potentially more problematic even than direct methods. They involve techniques by which an adversary can obtain either an economic interest in or voting control over a target company without direct legal ownership of the equities or bonds of that entity. These indirect methods are used daily in a variety of commercial transactions for perfectly normal reasons related to the tax, accounting, anonymity, and liability preferences of investors. As in the case of the direct methods described above, there is nothing underhanded about such techniques *prima facie*. However, since adversaries do not face many of the tax, accounting, and liability burdens faced by commercial investors, it is fair to ask why they might use these techniques other than for reasons of anonymity.

The simplest form of indirect ownership is for the adversary to buy units in a hedge fund or private equity fund which then makes investments in the name of that fund without disclosing the indirect ownership of the adversary. Normally, the interests of the adversary are undivided and shared *pro rata* with all of the other investors in the private fund. Also, investors in a private fund are typically passive and have no voice in the target selection of the private fund manager. However, there are several important exceptions to and variations on these basic rules which might lead to a different result. These indirect investment techniques and others can be used in combinations to multiply their effects on target companies. A conduit company sponsored by a Swiss trustee of an adversary can enter into a total return swap on a target company's stock with an investment bank acting in concert with a hedge fund which runs a managed account for the same adversary, and so forth. The permutations are endless.

Techniques for Market Manipulation

Proliferation experts are familiar with the concept of dual-use technology—specialized tools, parts, and methods which can be applied to acceptable commercial activities but which can equally be adapted to uranium enrichment, missile development, and other WMDs. It is time to

understand adversary financial capacity as a kind of dual-use technology also—something which can be applied for both investment and geopolitical aims. As with military dual-use technology, the difference can be almost impossible to discern until the technology is actually deployed.

A good example in the adversary context is the use of outside money managers. This is actually something which should be commended and included on a list of best practices because of the expertise made available to governments which may not be experienced in modern portfolio management techniques. For example, Norway's sovereign wealth fund (SWF), which is widely hailed as the model of best practice, employed 47 external managers at the end of 2007, many of whom are among the most successful and highly reputable managers in the world. On the other hand, selection of outside managers can disguise the identity of the true beneficial owner of investment funds. Use of multiple outside managers can be a way to accumulate large positions in toto without any one manager's position raising undue suspicions.

Debating whether use of outside managers is a good or bad practice is therefore a false dichotomy and a fruitless debate. The answer is that it may be good or bad depending on adversary intentions and other facts possibly unknown to the analyst. This is not to suggest that adversary investment pools such as SWFs are a threat, per se, or that it is even likely that most adversaries will engage in any of these activities with a view to hidden objectives and geopolitical advantage. Free and open capital flows are just as important as free and open trade flows in the maintenance of a productive and balanced global economy, and those flows should not be impeded without good cause. Instead, those concerned with economic security in the context of national security must be aware of the risks and dangers with a view toward developing objective tests and metrics which may be applied to assess those risks and to facilitate a robust intelligence and analytic function with respect to them.

Dual-use technology is benign until the moment it is not. Avoidance of a financial Pearl Harbor will require expertise and unending vigilance. With this dual-use potential as necessary background, there are a number of potential national security threats from adversaries, along with some indications and warnings, which might be considered in assessing those threats. Among US agencies warning of these potential threats, some of the most thoughtful analysis has been provided by the Securities and Exchange Commission (SEC) in several speeches by former chairman Christopher

Cox and other senior officials. These warnings related primarily to market manipulation and insider trading. Market manipulation is always illegal, and insider trading may or may not be illegal depending on how the inside information was obtained.

One of the SEC's principal warnings concerns the use by sovereign wealth funds of privileged access to nonpublic information to engage in insider trading. Such information can be obtained formally through participation in board meetings (which is one of the reasons board seats in SWF acquisitions are so controversial in addition to the voting rights and influence which are obtained) and informally through observer status at board meetings and loaned executives and training programs, which allow officials of the SWF legal and possibly illegal access to the internal day-to-day operations of a target company. It is not the case that SWFs need to be in control of target companies to gain this kind of access. Most public companies will make CEOs or other well-placed executives available to meet with large shareholders if their holdings are on the order of 5 percent to 10 percent, which is well short of most control definitions. Informal gatherings—dinners, trade shows, golf outings, other sporting events, and shared rides on a corporate jet—are all useful venues for obtaining material nonpublic information. The SEC has long recognized dangers of this type but, in the case of SWFs, is particularly concerned with its limited ability to obtain cooperation and enforce legal jurisdiction in the sponsoring countries of the SWFs or the SWFs themselves.

Quite apart from the use of inside information for securities manipulation, stealing information is an end in itself when the information obtained involves military or civilian technology secrets such as formulae, processes, plans, and intentions. There are numerous instances of such theft, often conducted through classic espionage and often involving the Chinese. While the existence of such threats goes well beyond the problems of SWFs, the financial leverage, corporate control, and privileged access used by SWFs can either be a direct channel for espionage or a useful supplement to information sought or obtained through non-SWF espionage channels. Adversaries pursuing geopolitical and strategic aims will be motivated to avoid detection by intelligence organizations to successfully achieve their goals. Techniques useful in this endeavor include traditional methods of operational security such as need-to-know and cell-like structures, as well as multiple dealers, multilegged trades, misdirection, self-administration, derivatives, and announcement effects.

Multiple Dealers

Adversaries can easily open trading accounts with hundreds of major banks, broker-dealers, insurance companies, and other large financial intermediaries around the world. While this is not a large number for a bank or a dealer, it is an extraordinarily large number for an end user or adversary. Among other things, this allows large trades to be broken up into small parts and spread among many dealers so that no single dealer is aware of the full scope and size of the trade. This also facilitates trading in smaller lot sizes so that each trade does not have a large effect on market prices, whereas conducting the entire trade at once can deplete all available liquidity and move prices in ways adverse to the goals of the adversary. It also permits 24-hour trading, as these dealers may be dispersed geographically in all major trading time zones. In situations where trades have to be executed on centralized exchanges, similar techniques can be used by employing multiple individual floor brokers or electronic trading platforms to execute small parts of a much larger strategy.

Multilegged Trades

Trading strategies can be composed of numerous parts, often devised in long links or chains with certain elements canceling out part of the risk of certain other elements so that only the net or residual risk remains with the fund. An example might be selling puts on stock indices and simultaneously selling all of the underlying stocks in the index so as to neutralize the market risk in a situation where the put goes in-the-money (with the stock position being reduced or eliminated as the put goes deeper out-of-the-money) and, assuming the transaction were denominated in euros, selling euros forward against dollars to convert anticipated profits back into dollars if that is the base currency of the adversary. The foregoing would represent an effort to isolate exposure to theoretically mispriced options' volatilities while factoring out stock market risk and currency risk. More complex trades of seven, eight, or more individual parts can easily be constructed. By placing each leg of such a trade with a different dealer, no single dealer could understand the entire strategy and might even draw conclusions opposite to what is actually transpiring.

Misdirection

This is a simple technique, not unlike the head fake in football, where an adversary wishing to *buy* a large quantity of a particular security begins by *selling* some in a highly conspicuous manner and leaking the details of the sale such that rumors begin in the marketplace that “such-and-such large fund is selling.” This causes others to follow the trend, driving prices down, at which point the adversary begins to buy quietly at levels which are significantly more attractive than when the false signal was originally given.

Self-Administration

Administration is one of the least-understood aspects of fund operations. It is basically the back office, or operational side, of trading consisting of:

- comparison of internal trade tickets with tickets generated by trading counterparts;
- confirmation of trades and reconciliation of any discrepancies which arise;
- movement of cash and securities collateral into or out of the fund’s accounts, depending on whether margin is due to or due from the fund;
- periodic payments to or from counterparts under contractual arrangements, that is, swaps; and
- calculation of net asset value of the fund and periodic reporting to interested parties.

Many of these functions are handled by third-party administrators or prime brokers, or both, under bilateral contractual outsourcing agreements with the fund. However, it is possible to handle most, if not all, of these functions in-house by building up a large enough staff and installing sufficient systems and telecommunications links to banks, brokers, and sources of pricing information. This means that *no one outside the adversary’s investment pool, not even the prime broker on whom the fund relies the most, can see the entire pattern of the adversary’s trading*. Even derivative agreements with notional value many times the value of actual securities held at the prime broker can be administered internally and not shown to the prime broker. This practice is unusual, partly because it is extremely expensive to support the staff and systems needed to do it well. Many

private funds do not even attempt self-administration but rather rely entirely on third parties for all critical functions relating to movements of cash and securities, trade verification, position valuation, and calculation of profit and loss. However, an adversary desiring maximum secrecy as to its activities would internalize at least some of the fund administration functions; there are a number of very large and well-known private funds which do so today.

Derivatives

One of the core views informing the analysis of adversaries today is that they do not use leverage, either explicitly in the form of borrowed money or implicitly in the form of the notional value of derivatives. However, in the absence of transparency by adversaries, this view may simply be an act of faith; there is really no way to know if adversaries are using leverage or not. Any effort to manipulate or damage markets would almost certainly employ derivatives because they are an enormous force multiplier to the adversary's unleveraged holdings. Derivatives come in many forms, such as futures, swaps, and options, and can be conducted in combinations (e.g., a swaption is an option on a swap, and a commodity futures option is an option to enter into a futures contract, etc.) and in numerous strategies, such as caps, floors, straddles, strangles, volatility trades, and so forth. The attractions of derivatives in terms of disguising trading patterns are:

1. They do not appear on balance sheets under GAAP or IAS (although, the notional value of derivatives is included in the footnotes).
2. They often allow for greater leverage than exchange-traded instruments (including potentially infinite leverage if no "haircut" or good faith margin is required by the dealer).
3. They can be conducted on a bilateral or over-the-counter basis directly with a dealer, thus avoiding publicly reported price and volume tickers and exchange surveillance units (nota bene: a correlative disadvantage is that the dealer knows the adversary counterpart by name and may be able more readily to identify a suspicious trade, at least after the fact).

4. Derivatives can be highly customized to capture unique subsets or combinations of market activity rather than be limited to particular stocks, bonds, and indices.

Announcement Effects

This is simply the use of reputation, capital, and high profile in financial markets to achieve certain effects or to condition the behavior of others through a statement of intentions without actually concluding the intended conduct. Clearly it cannot be used repeatedly without diluting the reputation of the announcing party and therefore the effectiveness of the technique itself, but used sparingly and in the right circumstances, it can be quite effective without the deployment of any funds at all. It can take the form of an announcement to acquire a target company in a hostile manner or the abandonment of some previously announced plan or intention so as to cause a decline in the stocks of those companies in the abandoned sector.

These techniques should be evaluated in terms of their marginal impact on markets, which are often not as deep or liquid as outsiders assume. Any market will have some natural equilibrium between buyers and sellers based on distributed risk and liquidity preferences and varying interpretations of news. It is not necessary to overmatch the entire weight of the opposing view to manipulate a market. It is only necessary to add one's weight to the supporting view so that, at the margin, that view begins to predominate and the market begins to turn in the targeted direction. Such conduct by an adversary is then like adding a seventh person to one side of two evenly matched, six-person teams in a tug-of-war. The added person does not single-handedly have to beat the opposing six; just adding his or her weight to the six on that side causes the desired outcome. When considering how large adversary investment pools are and how thin many markets are, perhaps a better analogy would be adding six members to one side of the contest.

Another disturbing trend which can be supported by the use of adversary financial resources is the move toward private pricing rather than market pricing. This arises where a supplier and consumer enter into exclusive long-term purchase and sale agreements using formulaic prices not necessarily tied to market prices. Certainly, producers have always been willing to offer discounts for large-scale and long-term customers and to do so can be commercially reasonable. But these

more recent arrangements involve numerous other elements such as loans, infrastructure finance, exclusivity, military assistance, technology transfer, and other nonmonetary considerations which make it impossible to isolate the market price of some underlying commodity. As these arrangements proliferate, progressively more of the global supply of certain commodities is delivered off market, such that the leading exchange-traded markets become thinner, less reflective of true value, and correspondingly easier to manipulate. Some observers have questioned whether this phenomenon has not become the case in oil futures contracts; that is, progressively more oil is being traded in private off-market arrangements involving China, Iran, and Sudan, while Saudi Arabia is able to manipulate oil futures prices higher on relatively light transactions volume, especially just ahead of the closing bell (a practice known as “painting the tape”). Of course, all of the foregoing techniques of market manipulation are even more powerful when used in combination to achieve adversary objectives.

Another threat arises from the ease with which adversary fund sponsor nations, particularly China and Saudi Arabia, could increase the size of their SWFs overnight. China has allocated \$200 billion of its approximately \$1.7 trillion in foreign exchange reserves to its SWF; however, since most analysts agree that \$1.7 trillion is far in excess of what China reasonably requires either to defend its currency or to provide for emergency domestic economic needs, it could simply decree that, say, \$500 billion more will be added to its SWF overnight, making it larger than some estimates of the Abu Dhabi Investment Authority (ADIA) and the first or second largest in the world along with Saudi Arabia. Therefore, no particular comfort should be derived from current estimates of SWF absolute or relative size, because in some cases that size can be materially altered at will.

Finally, another area of concern is the high correlation among SWF size, transparency, and strategy. Norway is an example of a fund which is large, passive, and highly transparent. More disturbing are funds such as Saudi Arabia, China, and the ADIA which are large, nontransparent, and more strategically focused. In a world of limited intelligence resources and endless possibilities for manipulation, these metrics are useful in deciding how to allocate resources for observation, investigation, and counter-intelligence.

Vulnerabilities Due to Persistent Economic Stagnation

Much attention in the foregoing sections focused on potential malign financial acts and manipulations which could be inflicted on the United States by adversaries using their capital resources and investment pools. However, it may be that the greatest economic threat to national security arises not from exogenous attacks but from endogenous weaknesses arising from the current financial crisis. Endogenous weaknesses are likely to be exponentially more catastrophic than policy makers realize, in light of the power law and critical-state analysis advanced above.

Picking a bottom in financial markets is a popular pastime for investors and market analysts, but *economic security* analysis should be more concerned with what happens once the bottom is reached. All falling markets find a bottom eventually. The Dow Jones index may fall to 5,000 or even lower, but it will stabilize at some point. The important issue for *economic security* is what happens then. There seems to be an a priori assumption, or maybe just a large dose of wishful thinking, that when the markets bottom they will bounce back and quickly recover most if not all of the lost ground, eventually reaching new highs. This is certainly the mantra of buy-and-hold analysis, which says that it is foolish to sell stocks at low levels because you will miss the rebound or be out of the market on that hypothesized single day when the Dow rises 1,000 points and your losses are erased in one quick burst of euphoria.

But what if markets do not bounce back? What if they go down and stay down? The problem with the bounce-back view is that the pertinent evidence is much to the contrary and not at all encouraging. Volatility is a powerful feature of markets today, and we would not rule out large, one-day rallies in major stock indices from time to time. But the evidence from bubble behavior shows that once we hit bottom (and we may still be a year or more away, depending on the particular asset class or index considered), we should expect a prolonged and pernicious period at the bottom itself without any appreciable gains for years. The implications of this for tax revenues, fiscal stability, US economic power, and the ability of the United States to project hard or soft political power are daunting.

Market technicians refer to this as the “LUV problem,” using the letters L, U, and V to denote types of market behavior following a collapse of the kind we are now experiencing. Most optimistic and quite common in cyclical downturns is the V-shaped recovery in which the economy as a whole or some important subcomponent declines rapidly, hits bottom,

and bounces back quickly to the former high level and beyond in something that looks like a V when plotted on a graph. Such behavior has been observed many times, notably in the Russia-LTCM crisis of 1998–99 when the Dow Jones Industrial Average dropped from 9,337 to 8,028 (a decline of almost 15 percent) in 10 weeks, from mid-July to late-September 1998, but regained all of the lost ground by the following January and went on to a new high of 11,497 by the end of 1999. An investor who sold at the bottom on 25 September 1998 and stayed out would have missed a gain of 43 percent in the following 15 months. Examples such as this give the V story a lot of its power among salesmen and pundits.

Also not uncommon is the U-shaped recovery in which the economy or certain indices first fall, then remain at or near the bottom for an extended period before regaining their old highs. The difference between the V and U, of course, is the time spent bouncing along the bottom, but investors in both situations are encouraged that some rebound is in sight. A good example is the 1990–91 recession. In that episode, the Dow reached 2,900 at the beginning of July 1990 then fell to 2,510 by early October 1990—a 13.4 percent decline. However, by the end of November 1991 it had only recovered to 2,894, just below where it had been 17 months earlier. The period in between included an extended trough, which gives the U-shaped graph its name.

This brings us to the last of our trio of market graphs, the L-shaped recovery which, in fact, means no recovery at all, at least not in any time frame in which the recovery is causally linked to the original decline. An L-shaped phenomenon represents a sharp decline followed by a prolonged and open-ended period of stagnation or malaise in which the recovery, when it does finally arrive, probably needs to be jump-started by some extreme event, such as a war, that is dynamically disconnected from the cause of the decline. Many recessions are said to carry the seeds of their own recovery; the L-shaped decline decidedly does not. The most famous example of this is the Great Depression, in which the initial industrial contraction lasted 43 months (August 1929 through March 1933) followed by a weak recovery and a second decline of 13 months (May 1937 through June 1938) followed by a second weak recovery. The Industrial Production Index calculated by the Federal Reserve stood at 8.6646 on 1 July 1929 and 8.8115 on 1 March 1940; a total increase of only 1.5 percent after 10 years and 8 months.

Another famous example of L behavior is the Nikkei 225 index of leading Japanese stocks traded on the Tokyo Stock Exchange. After reaching an all-time closing high of 38,915 on 29 December 1989, it dropped precipitously and reached an interim low of 14,517 on 30 June 1995; a spectacular decline of 63 percent in 4 1/2 years.

But the story does not end there. After several rallies and new declines, the index ground down to other interim lows of 7,907 on 2 May 2003 and then 7,162 on 27 October 2008—a breathtaking 81.6 percent below the all-time high reached almost 19 years earlier. Around 1999, analysts started talking about Japan's Lost Decade. They still do but seem not to have noticed that another 10 years have gone by with no progress.

Another example closer to home is the NASDAQ Composite Index, which reached an all-time high of 5,048 on 10 March 2000 and today trades around 1,985; about 60 percent below the all-time high almost nine years later.

What the Depression, Nikkei, NASDAQ, and other similar episodes all have in common is that they were preceded by bubbles. The Depression and the Nikkei collapses both followed bubbles in real estate and stocks. The NASDAQ collapse was associated with the dot-com bubble bursting. Bubble behavior is characterized by a sudden rise from a previous low level which feeds on itself until it achieves a hyperbolic spike followed by an equally violent downward break then a prolonged period at a relatively low level compared to the previous peak. What is most striking is the enormous amount of time between the spike and the return to anything approaching that level. Recovering from the Depression took more than 10 years in terms of industrial production, although some markets, including commercial real estate, did not recover until the mid-1950s, 25 years after the 1929 crash. The Nikkei has still not returned to its peak after 19 years. The NASDAQ has not returned to its peak after nine years. Contrast these time periods to the pundits who declare (without analysis) that the stock market will reach new highs by late 2009 or that housing will recover by early 2010 and you begin to see the problem.

What the United States has just experienced is the breaking of numerous bubbles in residential housing, credit card debt, consumption versus savings, growth in derivative products, growth in structured products, and the willingness of investors to use leverage and sell volatility to chase illusory gains. These breaks are not characteristic of normal cyclical downturns of the type which occurred in 1990–91 and 2001 or even the more

severe downturn of 1973–75. The US economy has entered a prolonged and steep decline, which could reduce real GDP by 20 percent or more over the next several years with no immediate prospects for recovery.

The defense, intelligence, and diplomatic communities should expect a potent mixture of increased missions due to failed states, civil unrest, and enemy adventurism induced by our economic weakness and a world of diminished resources due to fiscal constraints and rising demands for bail-outs and the social safety net. The combination of increased missions and reduced resources will stress readiness, analytic and collections capability, and priorities across the board. In the LUV trio, the L-shaped recovery is the one most dangerous for national security and also the one most likely to occur.

Collapse of the US Economy and of the US Dollar as a Reserve Currency

A sudden, catastrophic collapse is even worse than the long, slow grind along the bottom described above. In the event of a collapse, the greatest threat to US national security is the destruction of the dollar as an international medium of exchange. Destruction does not necessarily mean total elimination, but rather a devaluation of 50 percent or more versus broad-based indices of purchasing power for goods, services, and commodities and the dollar's displacement globally by a more widely accepted medium. This can happen more easily and much more quickly than most observers imagine. The example below hypothesizes a single country, Russia, acting unilaterally to require that all of its exports (principally oil and natural gas) henceforth be paid for in a new gold-backed currency issued by a newly formed fiscal agent of the Central Bank of Russia based in London. However, variations on this plan can easily be imagined, including a joint announcement to similar effect by Russia and China or an even larger group under the auspices of the Shanghai Cooperation Organization and in affiliation with Iran.

The fictional press release from the Central Bank of Russia shown below illustrates how quickly and easily a Pearl Harbor-style dollar attack might be executed. This press release addresses numerous technical issues—including acceptable rule of law, enforceability, settlement and clearance facilities, lending and credit facilities, and so forth—all of which would be subject to further analysis and the articulation of detailed policies and procedures in a real-world

implementation. However, there is nothing new or particularly daunting in any of this. The point here is to show how easily this could be done.

Центральный банк Российской Федерации **The Central Bank of the Russian Federation (Bank of Russia)**

Press Release, May 13, 2010

MOSCOW: The Central Bank of the Russian Federation (CBR) hereby announces the following facilities and processes which are in place and available for counterparty inquiry immediately:

Point 1. CBR has arranged long-term use of vaults in Zurich and Singapore capable of holding up to 10,000 metric tonnes of gold. Security is provided by G4S and is state-of-the-art including multiple security perimeters, biometric scanning, advanced encryption standard 264-bit encryption of communications channels, blast proof construction and redundant power supplies. CBR has moved the gold component of the Russian Federation international reserves to these vaults amounting to approximately 500 metric tonnes.

Point 2. CBR announces the issuance of the Gold Reserve Dolar (GRD) to be issued in book-entry form by the Global Dolar Bank plc in London (SWIFT: GDBAGB) acting as fiscal agent of CBR. One GRD is equal to one kilogram of pure gold (the Fixed Conversion Rate [FC Rate]). The GRD is freely convertible into gold at the FC Rate and is freely transferable to any designated party on the books of the Global Dolar Bank or any other approved bank maintaining GRD accounts. CBR invites creditworthy and prudently regulated banks worldwide to open GRD accounts and facilities on their books which can be cleared on a real-time gross settlements basis via Global Dolar Bank. The Global Dolar Bank clearance, settlement and accounts systems are operated on IBM Blade Servers using Logica CAS++ payments solution software.

Point 3. The Gold Reserve Dolar may be acquired in any quantity by delivery of the appropriate amount of gold at the FC Rate to any one of the vaults noted in Point 1. Upon receipt of good delivery, the pertinent number of GRD's will be credited to the delivering party's account at Global Dolar Bank. Gold Reserve Dolars are freely redeemable into gold in any quantity by instruction to Global Dolar Bank and by providing delivery instructions to one of the vaults.

Point 4. All matters pertaining to title, transfer and operation of GRD's and Global Dolar Bank plc are determined solely under English law and heard exclusively in English courts. All matters pertaining to physical possession, delivery and receipt of gold in the vaults will also be determined solely under English law and may be heard either in English courts or courts located in Switzerland and Singapore respectively. Opinions of law from Queen's Counsel and leading counsel in Switzerland and Singapore respectively are available for inspection.

Point 5. Effective immediately, all sales of Russian exports may be negotiated, denominated and paid for in GRD's only. The existing Russian Ruble will continue to be legal tender for domestic transactions conducted solely by parties within the Russian Federation.

Point 6. Effective immediately CBR announces a tender for unlimited quantities of gold. Any gold tendered under this facility will be paid for by delivery to the seller of U. S. Treasury bills, notes or bonds at an exchange value calculated by reference to the market value of securities determined in USD closing prices on Bloomberg and the market value of gold determined in USD by the London fixing, both for the average of the three business days immediately preceding the settlement date of the exchange.

Point 7. CBR will provide GRD lending facilities and GRD swap lines via Global Dolar Bank plc for approved counterparties with eligible collateral as determined in the sole discretion of CBR.

The intention of the Central Bank of Russia would be to cause a 50 percent overnight devaluation of the US dollar and to displace the dollar as the leading global reserve currency. The expected market value of gold resulting from this exchange offer is \$4,000 per ounce; in other words, the market clearing price for gold as money on a one-for-one basis. Russia could begin buying gold at the market price, perhaps \$1,000 per ounce initially; however, over time its persistent buying would push gold-as-money to the clearing price of \$4,000 per ounce. Gold selling would stop long before Russia was out of cash, however, as market participants realized that they preferred holding gold at the new higher dollar-denominated level. Gold will actually be constant, for example, at one ounce = 25 barrels of oil; it is the dollar that depreciates. In this scenario we are not pricing gold in terms of dollars, we are repricing dollars in terms of gold; so, one dollar is eventually redefined as the equivalent of 1/4000th of an ounce of gold. This can be a very attractive trade-off for a gold power like Russia. Thereafter, the world could become divided into gold haves and have nots, the same way it is with oil reserves today. For those dealing in gold, oil, grain, and other commodities, nothing changes; only the dollar goes down. Basically, the mechanism is to switch the *numeraire* from dollars to gold; then things start to look different, and the dollar looks like just another repudiated currency, as happened in Weimar and Zimbabwe. Russia's paper losses on its dollar securities are more than compensated for by (a) getting paid in gold for its oil, (b) the increase in the value of its gold holdings (in dollars), and (c) watching the dollar collapse worldwide.

Another important concept is the idea of setting the global price by using the marginal price. Russia does not have to buy all the gold in the world. It just has to buy the marginal ounce and credibly stand ready to buy more. At that point, all of the gold in the world will reprice automatically to the level offered by the highest bidder, in this case Russia. The market may test Russia's willingness to buy, just as hedge funds periodically test the credibility of central banks to defend their currencies; however, before Russia would be forced to buy \$200 billion worth of gold (about 1,500 metric tonnes at \$4,000 per ounce, \$200 billion being about how much US dollar liquidity they have), the world would decide it likes holding onto gold at the new price. So the world will wake up to find a new dollar/gold equilibrium. If China joins Russia in this plan, its success is assured.

The question for the national security community is not whether this can happen—it can. The questions instead are: Can steps be taken to prevent this from happening? What are the key indications and warnings that it is actually happening? What are the immediate consequences to US national security of this happening?

This plan takes into account the current reality. There is no existing currency which can displace the dollar; they all have worse problems, and there are not enough liquid instruments denominated in those currencies to absorb world savings. But a new currency could be launched as described above, backed by gold at a fixed rate, cleared and settled through existing banking channels, and with swap and lending facilities available. In principle, a private institution could do this (as had been done routinely prior to 1933), but a nation-state is a more credible candidate. The United States seems not to take the idea seriously and benefits from its ability simply to print dollars. China has little gold and too much to lose from being financially codependent on the United States. The European Union is not a country, and most of the gold in Europe belongs to the nation-states, not to the European Central Bank. The obvious candidate is Russia, which has very little to lose; its currency is worthless abroad and imploding at home, but it does have a decent gold supply above ground—about 500 metric tonnes—and excellent mining capacity. The objections to Russia have to do with trust and the rule of law, but these are easily solved as described above by using Switzerland and London as physical and legal venues. All it would take is for the Russians to trust themselves—not an insignificant obstacle.

The United States could prevent this by preempting it, just by issuing a gold-backed dollar itself using the 4,600 metric tonnes available in Fort Knox (over nine times the Russian gold supply). Another approach is to convene a Bretton Woods II conference, likely a G-20 meeting in today's world, and implement this on a global basis. The standard objection to gold-based money is “there's not enough gold.” Of course this argument is specious because there is always enough gold; it is just a matter of price. At \$900 per ounce, the total above-ground world gold supply will not support the total money supply of the leading trading nations. But at \$4,000 per ounce, the gold supply is adequate. Other objections to a gold-backed currency based on the failures of the Gold Exchange Standard of 1926–31¹⁵ are *in apropos* because those failures had nothing to do with gold and everything to do with mispricing; central bankers of the 1920s

wanted to revert to pre–World War I prices and exchange rates, which were not sustainable after the paper money inflation of the war years. What is needed today is a unilateral or multilateral repricing to a realistic level, which is exactly what President Roosevelt attempted in 1934 when he redefined the dollar from 1/20th of a gold ounce to 1/35th. In effect, one US dollar would now be defined as equivalent to 1/4000th of a gold ounce. This path, while practical, is entirely unlikely because of the lack of serious political or academic interest or understanding and the plain convenience of printing dollars. A more likely outcome is that the United States will not act to prevent the destruction of the dollar until something like that is already underway.

As for indications and warnings, they are easy to specify and detect; the issue for the national security community is whether anyone is looking and whether the proper analytical tools are in place. Russia's gold reserves, denominated in dollars at current prices, increased from \$14.5 billion to \$15.5 billion in January 2009. Why? Who is minding that store? A dedicated watch function combined with appropriate analytics could provide some early warning of an effort to launch a gold-backed currency, especially since either China or Russia would have to place the gold outside their home countries to engender trust among those willing to rely on the new currency. Acquisition of gold by central banks and physical movement of gold to neutral vaults could all be tracked using information from exchanges, dealers, banks, and secure logistics firms such as Brink's and G4S. Techniques such as calculating the second derivative of the slope of a curve tracing the time series of the spread between spot physical and Comex near-month gold futures may be especially revealing.

The consequences of failing to detect the threat or to act on it are, in a word, devastating. Imagine a world in which the price of oil measured in units of gold is held constant at one ounce = 25 barrels, but the price in dollars instantaneously becomes \$155 = one barrel based on the new dollar/gold exchange rate. Then apply similar ratios to all US imports of commodities and manufactured goods. The result is that the US would re-import the hyperinflation it has been happily exporting the past several years. US interest rates would skyrocket to levels last seen in the Civil War to preserve some value in new dollar investments. US exports of services such as insurance, education, software, consulting, and banking could fare better, however, if priced in the new unit of account. The United States, China, and Japan might unite in a closed dollar bloc to fend off the im-

pact of the new Russian gold currency, but at best this would restrict world trade; it seems more likely China and Japan would act in their own self-interest and try to make peace with the new currency in terms of their own paper currencies. Gold-producing nations such as Australia, Canada, and South Africa might do relatively better than some others. Large gold-owning nations such as the United States, the United Kingdom, and Germany might stabilize by joining the new world currency, but this is more likely to occur after suffering initial disruption rather than proactively guiding the process.

China could engage in its own attack on the US economy quite apart from whether it chose to join Russia in the use of the gold standard based on a new unit of account or even lead such an effort itself. China's other line of attack runs through its voluminous holdings of US Treasury debt (estimated to be well in excess of \$1 trillion) and the need of the United States for China to continue to purchase new issues of such debt, likely to be \$5 trillion or more taking into account baseline deficits, temporary stimulus spending, new budget proposals, financial rescues (such as TARP, TALF, Bear Stearns, and others) and as yet unrealized losses and associated bailouts arising from new losses in credit cards, student loans, auto loans, corporate bonds, commercial real estate, and other nonsustainable credit. China could simply dump, say, \$100 billion of its longest-maturity US Treasury securities on the market at one time combined with an announcement that it intended to sell far more when, as, and if market conditions warranted. Such an action would cause an immediate and substantial rise in intermediate- to long-term US interest rates. This is the sector which is most relevant to mortgage and corporate credit (versus the short-term sector, which is more relevant to interbank lending, money market investments, and other cash substitutes). This would further weaken the already weak housing and manufacturing sectors and likely cause a substantial increase in unemployment, home foreclosures, bank failures, and corporate bankruptcies. The end result would be to force the economy into an unpalatable choice between hyperinflation and protracted economic decline resembling the Great Depression, perhaps worse.

The conventional objection to such action on the part of the Chinese is that they would hurt the value of their own securities and incur massive losses on their portfolio holdings. This objection is intellectually and analytically shallow. Portfolio investors may choose to view their holdings as held to maturity or held for trading. It is true that if China were to

attempt to liquidate holdings beyond the initial \$100 billion suggested above that they would receive substantially less than par value and thereby realize capital losses. However, China is under no such constraint and can simply hold onto its securities until maturity and receive all coupons and 100 percent of principal at maturity, thereby suffering no losses beyond those incurred on the initial \$100 billion. One way to understand this is to think of homeowners with no mortgage whose homes have declined in value. If they intend to sell immediately to move to another city, then the decline in value may convert into a realized capital loss. However, if they intend to remain in those homes for the rest of their lives, the temporary decline in value is a financial artifact of no particular consequence. The Chinese are like the homeowners who intend to stay in their home forever. By operating through the marginal transaction (in a manner similar to that in which the Russians might operate in gold), they can affect the global term structure of interest rates without suffering actual capital losses beyond those incurred to move the market in the first instance. The announcement effect of the first sales, backed by a credible threat to sell more, will be enough to insure the semipermanence of increased intermediate-term US interest rates.

A second standard objection to this course is that the Chinese would suffer from decreased exports to the United States if they caused the US economy to collapse in this manner. However, China may find this an opportune time to stimulate internal domestic demand and convert its economy from an export-led model to a consumption-led model relying on internal markets to increase consumption.

Another more subtle but equally effective tactic which the Chinese might employ is to move down the yield curve. This is done by maintaining total Treasury holdings constant but allowing older, long-dated notes to mature and then reinvesting proceeds in shorter maturities. For example, China has a certain amount of US Treasury five-year notes which it purchased in 2004 and which are maturing in 2009. When those notes mature this year, China can choose to reinvest in one-year Treasury bills instead of notes with longer maturities. By doing so repeatedly, China will greatly shorten the maturity structure of its overall portfolio. This will give it greater liquidity and optionality in how it deploys its cash in the future (because its bills will always be close to maturity so it can redeploy cash-at-maturity without “selling” or “dumping” anything). This will also “steepen” the yield curve—meaning shorter maturities where demand is

greatest will have lower interest rates, and longer maturities where demand is less will have higher interest rates, *ceteris paribus*, thus increasing the differential between short-term and long-term rates represented as a steeper slope on a yield curve graph. This will cause higher interest rates for US mortgages and corporate debt *without* causing capital losses in China, since the effect will be achieved incrementally through the continual rollover process rather than through abrupt dumping. This is the interest rate equivalent of the death by a thousand cuts.

In summary, a well-timed and well-executed attack on the US Treasury securities market could result in a devastated US economy. The effects could involve depression or hyperinflation while China suffers very modest capital losses and continues to grow its economy with less reliance on exports to the United States. The destruction of the dollar through Russian unilateral issuance of a new gold-backed reserve currency and the destruction of the US economy through China's investment policies are the twin towers of external threats to US *economic security*.

National Responses

Despite the range of potential national security threats posed by adversaries and the diverse methods and immense resources at their disposal, investee nations such as the United States and others are not without considerable tools at their disposal to deter, detect, and defend against hostile or subversive actions by adversaries. These are considered below.

The first line of defense for the United States is the Exon-Florio Amendment to the Defense Production Act of 1950 which permits voluntary review of foreign investments in the United States by the Committee on Foreign Investment in the United States (CFIUS), a 13-member interagency body chaired by the US Treasury and with Cabinet-level participation from Treasury, Commerce, Defense, Energy, State, Homeland Security, Office of the Attorney General, Office of Management and Budget, Council of Economic Advisors, Office of the United States Trade Representative, National Economic Council, National Security Council, and the Office of Science and Technology Policy. The director of national intelligence and the secretary of labor are also nonvoting *ex officio* members. Exon-Florio and the role of the CFIUS were recently amended and expanded through the Foreign Investment and National Security Act of

2007 (FINSA) and an amendment to Executive Order 11858 issued on 23 January 2008.

The FINSA continues to allow for voluntary filings by foreign entities acquiring US companies but also allows the CFIUS to institute reviews on its own initiative. The FINSA applies to “covered transactions,” defined as those involving a merger, acquisition, or takeover of a US company which could result in foreign control of that company. Current regulations use 10 percent ownership as a threshold for control; however, it is not clear that this is the only indicia, and it has been urged that other indicia should expressly be adopted. Once a review has commenced, the CFIUS has 30 days within which to determine either that no threat to national security exists or that any potential threat has been mitigated through agreement with the parties. If, after 30 days, it is determined that a threat to national security does exist and no satisfactory mitigation has been achieved, the transaction moves to a 45-day investigation, at the end of which the CFIUS provides a written report and recommendation to the president, who has an additional 15 days to decide whether to suspend or prohibit the proposed transaction. However, acquisitions by SWFs (or other entities controlled by foreign governments) and acquisitions of critical infrastructure by any party will automatically attract the 45-day investigation, subject to certain narrow exceptions. The FINSA also contains provisions relating to withdrawals from proposed acquisitions, reports to Congress, and criteria for determining both threats to national security and the definition of critical infrastructure. The director of national intelligence is given the role of coordinating the input and analysis of all members of the intelligence community in support of the CFIUS’s role in evaluating threats to national security. The CFIUS has been a powerful and high-precision tool for protecting US national security interests while at the same time allowing the vast majority of proposed acquisitions to proceed (often with enforceable mitigation agreements) so as to maintain the US reputation for open and nondiscriminatory capital markets.

Securities Law

The United States has a comprehensive set of laws governing securities, futures, and derivatives transactions contained in the Securities Act of 1933, the Securities Exchange Act of 1934, the Investment Advisers Act of 1940, the Investment Company Act of 1940, the Commodity Exchange Act, and other acts, all as amended to date. These statutes contain robust

antifraud provisions and reporting provisions governing such matters as takeovers, 5 percent or greater positions; licensing of advisors, brokers, and exchanges; large trader reports; large position reports; margin requirements; reporting of purchases and sales by company officers and directors; short sales; fiduciary duties; conflicts of interest; and many other matters designed generally to provide fair, efficient, and transparent markets. The laws, rules, and regulations are implemented by large staffs at the SEC and the Commodity Futures Trading Commission (CFTC) dedicated to market supervision, including delegated authority to exchanges and their self-regulatory organizations. Enforcement is supported through SEC and CFTC investigatory and subpoena power, administrative judges, and access to the resources of the federal courts, the FBI, and the Department of Justice, as needed. Importantly, these rules (with few exceptions) apply equally to adversaries with regard to their transactions in US markets, with US counterparties, or through means of US interstate commerce. However, as noted above, where adversary investment pools and their home countries do not cooperate in investigations or allow access to information, enforcement of these rules against adversaries can be problematic.

Banking Law

Financial institutions such as banks and thrifts are subject to extensive regulation and oversight in addition to that which may be conducted by the SEC with respect to trading in the public securities of these institutions. The United States has numerous bank, thrift, and bank holding company statutes and multiple regulatory bodies to enforce these, including the Board of Governors of the Federal Reserve System, the Office of the Controller of the Currency, and the Office of Thrift Supervision, among others. The principal statute which would govern adversary firm acquisition of banks or thrifts is the Bank Holding Company Act of 1956 as amended by the Gramm-Leach-Bliley Act (1999). These statutes require regulatory filings and approval when certain investments in financial institutions exceed 5 percent and have other progressively more onerous requirements at ownership levels in excess of 19.9 percent and 24.9 percent. Depending on the exact type of instruments, voting rights, and contractual arrangements involved, these thresholds can be deemed to constitute “control” and are prohibited to acquirers engaged in nonbanking commercial activities. Separate review processes are applied to foreign acquirers having to do with banking regulation in their home countries. As a practical

matter, no adversary could legally obtain control of a US bank under these statutes.

Antitrust Law

The twin pillars of antitrust law are the Sherman Antitrust Act of 1890, which outlaws contracts or conspiracies “in restraint of trade or commerce,” and the Clayton Antitrust Act of 1914, which outlaws certain kinds of price discrimination, exclusive dealings, mergers which lessen competition, and directors serving on the boards of two or more competing companies. In addition, the Hart-Scott-Rodino Antitrust Improvements Act of 1976 amends the Clayton Act to provide for advance notification of certain mergers, tender offers, and acquisitions and requires a 30-day waiting period after notice and before closing during which regulatory agencies may request further information to evaluate whether the proposed transaction violates any antitrust laws. It is fair to say that many adversary investment pool transactions in Latin America, Africa, and Asia would violate US antitrust laws if conducted subject to the jurisdiction of the United States; in other words, certain acquisitions are done precisely for the purpose of price discrimination, exclusive dealings, to establish interlocking directorates, and so forth. The fact that these laws exist (and that similar laws exist in the EU) acts as a powerful check on certain abuses against fair trade, which might be pursued by an adversary but for these laws.

Export Administration Act

The Export Administration Act (EAA), which has been reauthorized and amended several times since its origin in 1949, establishes statutory authority and an administrative framework for regulating exports of dual-use or sensitive commodities, software, hardware, and information technology. The traditional bases for such restrictions were to prevent scarcity in the United States, to implement or support the foreign policy of the United States (including broad-based goals, such as human rights), and to prevent the export of goods with military applications to countries which posed a threat to US national security. While the EAA is a first line of defense from the perspective of US exporters and commodity producers, it is a kind of “second line of defense” after the CFIUS from the perspective of adversary firms and investment pools. While the CFIUS prevents acquisitions of sensitive US technology by foreign buyers in the

first instance, EAA can prevent target companies controlled by adversaries from exporting sensitive technology if the target acquisition had somehow escaped CFIUS intervention.

Tax Law

The implications of taxation on foreign investors in US capital markets is perhaps one of the least understood and most underappreciated tools in the US arsenal of legal defenses to hostile actions by adversaries. As in the case of securities laws discussed above, the field is too large and complex to be summarized adequately within the scope of this article. However, an overview of one particularly fraught area might be helpful in explaining what a powerful tool this can be. In general, US citizens, US permanent residents, and US corporations pay US income tax on global income regardless of where their assets are owned or activities are performed. Nonresident foreign persons, including adversary-country firms and investment pools, generally do not pay US taxes except to the extent that they are considered to be engaged in a trade or business in the United States or except for certain withholding taxes on payments of interest, dividends, royalties, and other recurring items from US sources. This begs the question of which activities do or do not constitute being engaged in a US trade or business.

Generally, the purchase and sale of securities and derivatives, including through US-based agents, will not subject an adversary firm or investment pool to US taxation (known as the securities trading “safe harbor”). However, some adversary firms may have been overly aggressive with respect to the safe harbor and may have exercised undue control with respect to US business activities or have become involved in loan origination, purchase, and sale activities which may not qualify for safe harbor treatment. In addition, some adversary firms are known to have arranged total return equity swaps with major investment banks so that they receive the economic benefit of dividends paid on underlying shares without suffering US dividend withholding taxes, since they purport not to own the shares themselves. To the extent these activities may constitute improper tax avoidance or illegal tax evasion, the adversary firms and investment pools, upon IRS audit and possible referral to the Department of Justice, may face back taxes, late interest, fines, penalties, and imprisonment. These tools should not be employed lightly, but they are powerful antidotes to certain overly aggressive investment techniques by adversaries.

International Emergency Economic Powers Act of 1977 (IEEPA)

The IEEPA is sometimes referred to as the “nuclear option” of financial regulation and not without cause. It allows the president to block transactions, freeze accounts, order embargoes, and confiscate assets in connection with any unusual and extraordinary threat to the national security, foreign policy, or economy which originates in whole or substantial part outside the United States. The act does require reporting to Congress and further requires that declared emergencies be renewed annually to remain in effect; emergencies may also be terminated by Congress under certain circumstances. Notwithstanding these reporting and termination provisions, the powers granted to the president to deal with economic or national security emergencies caused by actions of adversaries are near plenary. The United States has, in fact, used these powers many times in the past and has well-established executive branch processes and procedures involving the Departments of Treasury, State, and Justice and other departments and offices for the implementation and enforcement of any executive orders pursuant to the IEEPA.

Other Statutes and Regulations

In addition to the foregoing, there are numerous federal and state statutes and government agency regulations which limit the ability of foreign owners, including adversaries, to acquire interests in companies involved in particular industries, including telecommunications, shipping, and casinos, among others. Importantly, the US defense industry operates pursuant to the *National Industrial Security Program Operating Manual*, which governs access of all defense contractors to classified material and imposes stringent limitations on the access of foreign officers, directors, and shareholders to any such information.

In short, the United States is well prepared from a statutory and regulatory perspective to protect its national security interests from foreign control and dissemination to foreign parties, including adversary firms and investment pools. The United States also has seasoned and well-staffed agencies and private-sector partners to provide oversight and enforcement with respect to those laws, regulations, and processes. However, enforcement of those rules abroad in the host countries of adversaries can be problematic, especially if those countries refuse cooperation. And, no set of laws is proof against deliberate, malicious, and well-considered efforts to defeat or evade them, especially if the objective is not the acquisition and

control of a particular company or technology but disruption of critical infrastructure including the financial system itself. Defense against this type of activity requires a thorough understanding of the techniques which might be employed, portfolio metrics to assist in identifying situations where adversary behavior might be other than commercial investment management, development of a matrix of indications and warnings, and sound intelligence and analysis with respect to the intentions and actions of adversaries.

Fortunately the United States is not alone in this effort and is not the only country which has reservations about the actions of adversaries. This argues not only for other countries to be involved individually in seeking solutions to perceived problems of adversary investment but for truly multilateral solutions so that adversaries do not attempt to forum shop or play off one country's lax rules against another. A broad-based, multilateral solution also gives the investee countries more bargaining leverage because an adversary that does not want to cooperate with such rules may find it has no large, liquid, and well-regulated markets in which to invest.

Financial “Choke Points” and Clandestine Action

In addition to the overt national and multilateral policy tools described above, the United States can employ clandestine collections to obtain the information it needs to ascertain if adversary intentions are commercial or malign and to penetrate and disrupt those efforts which may be malign. To do so, it is critical to understand the financial and legal choke points which exercise the same influence in the commercial world as critical straits like Hormuz and Suez do in the world of maritime commerce and naval warfare.

Transactions of the type described in this article do not occur in a vacuum. Adversaries must have professional advisors and transactional counterparties to pursue their trading and investment objectives. It follows that those advisors and counterparties have information on adversary investment positions and structures at least to the extent that they are conducted in conjunction with that advisor. Adversaries require the use of legal entities, derivative contracts, trust agreements, account agreements, and numerous other formational and contractual documents. Local officials will also insist on minimal corporate formalities and periodic financial statements, even in those jurisdictions most lax in this regard.

While these opaque structures may be initiated by adversaries, they are enabled by a legion of lawyers, accountants, bankers, dealers, administrators, and others. These professionals typically operate within professional firms; however, some may act as sole practitioners or as small boutiques, particularly in offshore banking jurisdictions and tax havens, such as Cyprus or the Cayman Islands. These professionals not only perform indispensable services, they also may take the lead in suggesting the structures and techniques for managing and operating them. Portfolio managers and government agents at adversary funds may have goals in mind (e.g., “we’d like to exert de facto control of Company X without our interests becoming transparent, reportable, or easily traced”). It is often not difficult to invent what are superficially commercial reasons for such requests; however, professionals are often indifferent to the initiating party’s motivations and will simply execute the request. As a result, the professionals described above, particularly lawyers and accountants, will be the most likely parties to structure opaque transactions. It follows that they will have the greatest knowledge about the actual parties in interest and the intricacies of the structures.

While professional and financial firms use standard techniques of operational security, including limited access, biometric scanners, passwords, and need-to-know protocols, these are typically not as stringent as the OPSEC used in the intelligence community. In particular, a culture which discourages social engineering in intelligence work does not exist in the worlds of law, accounting, and finance, and dedicated counterintelligence resources are not nearly as robust. As a result, it is possible for a single well-placed professional within one of these firms to obtain access to a wide array of information without raising undue suspicion. This is even truer in the offshore financial centers, where standards are more relaxed and the choke points are even narrower, than in the large money centers.

For example, in a leading offshore finance jurisdiction, the Cayman Islands, there are perhaps 15 law firms which handle more than 90 percent of the transactional work. Of these, two firms—Walkers and Maples—handle about 50 percent. A source at one law firm can have good information about transactions at a rival law firm to the extent that the rival firm is representing the other side of a single transaction. Therefore, a single agent-in-place at a firm like Walkers with enough seniority and professional stature would be in position to obtain a material percentage of all the legal information on real parties in interest to otherwise opaque-structured financial transactions.

The same phenomena would exist, perhaps in more concentrated form, in smaller jurisdictions such as the Channel Islands or Cyprus.

In short, recruitment of agents among the ranks of professionals in law, accounting, and administration firms—as well as banks, brokers, and dealers, particularly in offshore jurisdictions—is an opportunity nonpareil to penetrate the opaque and complex structures described elsewhere in this article for the purpose of ascertaining the true positions and intentions of the adversary investment pool. Of course, such human intelligence activities can be greatly supplemented and enriched by a host of technical means targeted on these same professional and financial firms.

Conclusion

A clear understanding of the structures and vulnerabilities of the financial markets points the way to solutions and policy recommendations. These recommendations fall into the categories of limiting scale, controlling cascades, and securing informational advantage.

To explain the concept of limiting scale, a simple example will suffice. If the US power grid east of the Mississippi River were at no point connected to the power grid west of the Mississippi River, a nationwide power failure would be an extremely low-probability event. Either the “east system” or the “west system” could fail catastrophically in a cascading manner, but both systems could not fail simultaneously except for entirely independent reasons, because there are no nodes in common to facilitate propagation from critical state to catastrophic failure across systems. In a financial context, governments should give consideration to preventing mergers that lead to globalized stock and bond exchanges and universal banks. The first-order efficiencies of such mergers are outweighed by the risks of large-scale failure, especially if those risks are not properly understood and taken into account.

The idea of controlling cascades of failure is, in part, a matter of circuit breakers and pre-rehearsed crisis management so that nascent collapses do not spin into full systemic catastrophes before regulators have the opportunity to prevent the spread. The combination of diffuse credit and layered leverage makes it infeasible to assemble all of the affected parties in a single room to discuss solutions. There simply is not enough time or condensed information to respond in real time as a crisis unfolds. One significant circuit breaker which has been discussed for over a decade but

which has still not been implemented is a clearinghouse for over-the-counter derivatives. Experience with clearinghouses and netting systems such as the Government Securities Clearing Corporation shows that gross risk can be reduced 90 percent or more when converted to net risk through the intermediation of a clearinghouse. Bearing in mind that a parametric decrease in scale produces an exponential decrease in risk in a nonlinear system, the kind of risk reduction that arises in a clearinghouse can be the single most important step in the direction of stabilizing the financial system today; much more powerful than bailouts, which do not reduce risk but merely bury it temporarily.

A clearinghouse will also provide informational transparency that will allow regulators to facilitate the failure of financial institutions without producing contagion and systemic risk. Such failure (what Joseph Schumpeter called “creative destruction”) is another necessary step on the road to financial recovery. Technical objections to clearinghouse implementation based on the nonuniformity of contracts can be overcome easily through consensual contractual modification with price adjustments upon joining the clearinghouse enforced by the understanding that those who refuse to join will be outside the safety net. Only by eliminating zombie institutions and creating breathing room for healthy institutions with sound balance sheets can the financial sector hope to attract private capital to replace government capital and thus restart the credit creation process needed to produce sound economic growth.

In summary, Wall Street’s reigning risk-management paradigm, consisting of a combination of stochastic methods in a normally distributed model combined with stress testing to account for outliers, is a manifest failure. It should be replaced with the empirically robust model based on nonlinear complexity and critical-state dynamics. Applying such a paradigm leads to the conclusion that the current financial crisis is likely to get far worse and threaten national security because the system has been scaled to unprecedented size prior to the onset of the catastrophe. It also points the way to certain solutions, most importantly the creation of an over-the-counter derivatives clearinghouse, which will descale the system and lead to an exponential decrease in actual risk. Such a clearinghouse can also be used to improve transparency and manage failure in ways that can leave the system far healthier while avoiding systemic collapse.

Notwithstanding an earlier period of globalization during 1880 to 1914, there can be little doubt that the current period of globalization

from 1989 to 2009, beginning with the fall of the Soviet Union and the end of the Cold War, represents the highest degree of interconnectedness of the global system of finance, capital, and banking the world has ever seen. Despite obvious advantages in terms of global capital mobility facilitating productivity and the utilization of labor on an unprecedented scale, there are hidden dangers and second-order costs embedded in the sheer scale and complexity of the system. These costs have begun to be realized in the financial crisis which began in late 2007, have continued until this writing, and will continue into the future.

Among the emergent properties of this complexity is exponentially greater risk of catastrophic collapse leading to the complete insolvency of the global financial system. This dynamic has already begun to play out and will continue without the implementation of appropriate public policies which, so far, are not in evidence. More to the point, this ongoing instability lends itself to amplification through the actions of adversaries who can accelerate destabilizing trends through market manipulation and the conduct of marginal transactions in critical securities and commodities, such as US Treasury debt, oil, and gold.

The US response should include three components: (1) improved public policy to stabilize the system, including temporary nationalization of banks to remove bad assets, preemptive study and consideration of a return to the gold standard, higher interest rates to support the value of the US dollar, increased tolerance of failure in financial institutions to reduce moral hazard, and mandatory use of central counterparty clearing to mitigate the impact of institutional failure and descale the system to make it more robust to attack; (2) an expert market-watch function and all-source fusion with improved financial counterintelligence and clandestine action to detect and disrupt attempted malicious acts in global capital markets by adversaries; and (3) an offensive capability in global capital markets, including asset freezes, asset seizures, and preemptive market manipulations.

Finally, the vulnerability of companies and technologies to control and diversion by adversaries must not be overlooked. This requires improved interagency coordination of the various legal and forensic tools at the disposal of the United States in the areas of securities, antitrust, taxation, banking, export restrictions, direct foreign investment restrictions, sanctions, and emergency economic powers. These tools should be supplemented by improved financial counterintelligence and new automated

tools focused on supply-chain linkages, nonobvious relationship awareness, and market price anomalies. **SSOL**

Notes

1. John F. Cogan, Tobias Cwik, John B. Taylor, and Volker Wieland, *New Keynesian versus Old Keynesian Government Spending Multipliers*, February 2009, www.volkerwieland.com/docs/CCTW%20Mar%202.pdf.

2. For an excellent overview of these developments, see Peter L. Bernstein, *Capital Ideas: The Improbable Origins of Modern Wall Street* (New York: John Wiley & Sons, Inc., 2005).

3. More recent embellishments on the simple bell-curve model include T-models of implied volatility and GARCH (generalized auto-regressive conditional heteroskedasticity); however, these methods are also flawed because they continue to rely on normal distributions as a base case and frame of reference instead of abandoning the flawed methodology completely.

4. One reason EMH-Gaussian paradigm practitioners cling to the paradigm in the face of mounting contradictory empirical evidence is that the normal distribution curve lends itself nicely to the use of differential calculus, which is the branch of mathematics dealing with continuous phenomena as exemplified by the smooth shape of the bell curve. Calculus is a powerful tool, and it has been put to enormous use in solving the problems posed by modern financial economics. It has proved so efficacious that financial economists are loath to consider nonlinear dynamical systems (i.e., the new paradigm) because such systems are best approached with difference equations of the general form $x_n = rx(1-x)$ in which x is normalized at a value such that $0 < x < 1$ and represents the variable being studied (e.g., the level of a stock index today), X_n represents x in the next time period (e.g., level of the stock index in a future period), r is a function (i.e., growth rate of index) and $(1-x)$ is a limit, (i.e., while a small value of x will begin growing over time in accordance with the function with little perturbation by $(1-x)$, at progressively higher levels of x , the perturbations will increase such that x declines precipitously before growing again. Whether this system ever achieves a “steady state” depends on how the function is tuned. A graph of the output of this equation will display irregular growth with periodic steep declines; very much like actual market behavior. Importantly, such “difference equations” (unlike differential equations) display discontinuities rather than continuous functions. While reflecting empirical reality more accurately, such equations in more complex quadratic and trigonometric forms can be difficult to solve and are more difficult to apply to selected “problems” than differential equations. In this sense, EMH-Gaussian paradigm practitioners can be likened to the wayward professor at night looking for his dropped car keys several blocks from his parked car. When asked why he’s on the wrong block, he replies “because the light is better.” Theorists cling to the EMH-Gaussian paradigm, in part, because “the math is better.” They are still on the wrong block.

5. Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable* (New York: Random House, 2007).

6. This revolution in the intellectual framework for understanding capital markets corresponds well to the famous process of the “paradigm shift” outlined by Thomas E. Kuhn in *The Structure of Scientific Revolutions*, 3rd ed. (Chicago: University of Chicago Press, 1996). However, as Kuhn pointed out, the paradigm shift does not take place smoothly or instantaneously but is often characterized by an extended period during which adherents of the “old paradigm” continue to elaborate their theory with the increasingly convoluted solutions needed to account for perceived “anomalies” in their theory while proponents of the new paradigm are often marginalized or dis-

credited. This familiar overlap of old and new has persisted for the past 15 years; however, the Efficient Market Hypothesis does now seem ready to fall of its own weight. It is best understood as a “special case” within a larger general framework of nonlinear dynamical systems rather than the “general case” its proponents had originally described.

7. Per Bak, *How Nature Works: The Science of Self-Organized Criticality* (New York: Copernicus, 1996).

8. Although experiments using recursive difference equations applied to simple economic models of inventory accumulation do tend to confirm the theory. José A. Scheinkman and Michael Woodford, “Self-Organized Criticality and Economic Fluctuations,” *American Economic Review* 84, no. 2 (May 1994): 417–21.

9. Lui Lam, *Nonlinear Physics for Beginners: Fractals, Chaos, Solitons, Pattern Formation, Cellular Automata and Complex Systems* (Singapore: World Scientific Publishing, 1998).

10. Benoit B. Mandelbrot and Richard L. Hudson, *The (Mis)behavior of Markets: A Fractal View of Risk, Ruin, and Reward* (New York: Basic Books, 2004).

11. See Edgar E. Peters, *Chaos and Order in the Capital Markets: A New View of Cycles, Prices, and Market Volatility*, 2nd ed. (New York: John Wiley & Sons, Inc., 1996), *Fractal Market Analysis: Applying Chaos Theory to Investment and Economics* (New York: John Wiley & Sons, Inc., 1994), and the extensive references to additional research contained in both volumes.

12. “Growth of a Complex Market,” *New York Times*, 9 October 2008.

13. See Col Qiao Liang and Col Wang Xiangsui, *Unrestricted Warfare: China’s Master Plan to Destroy America* (Panama City: Pan American Publishing, 2002).

14. Since the defensive actions contemplated by this analysis would only occur during a time of financial warfare or extreme financial crisis, a delegation of emergency activation authority to the president seems appropriate. Clarifying amendments to the International Emergency Economic Powers Act of 1978 or the Trading with the Enemy Act would be an appropriate legislative vehicle to achieve this; however, the needed powers may already reside with the president, depending on the interpretation of those acts.

15. Barry Eichengreen, *Golden Fetters: The Gold Standard and the Great Depression, 1919–1939* (New York: Oxford University Press, 1996); and Ahamed, Liaquat, *Lords of Finance, The Bankers Who Broke the World* (New York: Penguin Press, 2009).