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Financial Risk Management in Practice:

The Known, The Unknown and The Unknowable

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Summary

Contents

1. Opening Address.....	1
2. Roundtable 1: The Known, the Unknown, and the Unknowable in Financial Policymaking.....	3
3. Roundtable 2: The Known, the Unknown, and the Unknowable in Banking	6
4. Roundtable 3: The Known, the Unknown, and the Unknowable in Venture Capital	12
5. Roundtable 4: The Known, the Unknown, and the Unknowable in Insurance and Reinsurance.....	16
6. Roundtable 5: The Known, the Unknown, and the Unknowable in Asset Management.....	22
7. Closing Remarks.....	27

1. Opening Address

*Michael Mussa, Senior Fellow
Institute for International Economics
Washington, DC*

Michael Mussa of the Institute for International Economics opened this annual conference on financial risk management by offering a historical perspective on some of the forces that have intruded on risk management over the years. He argued that understanding the differences between what is known, unknown, and unknowable is critical so that “financial risks may be managed within tolerable limits.”

Mussa, a former member of the President’s Council of Economic Advisors, emphasized the inevitability of risk: “To be alive is to be at risk,” he said, adding that “virtually every worthwhile endeavor entails some risk.” He said that simply minimizing or avoiding risk “is not what life is about,” nor is it necessarily an objective of financial management. Mussa argued that the proper goal for financial institutions and regulators is to “ensure that risks are not excessive and that they are efficiently allocated among those willing and able to bear them.” Achieving that, however, requires a “reasonable basis for assessing risk.”

He noted that in the past some public policies seeking to reduce risks in financial markets went “too far,” and he cited as an example, the regulations restricting the range of activities open to commercial banks. But now he said, “There is a more important problem, and that is policies which encourage excessive risk-taking.”

Mussa said it was appropriate that this conference was being held in Philadelphia because for the first third of the 19th century, it was “the most important financial center in the United States.” The First Bank of the United States, which was chartered in Philadelphia in 1790, functioned as a “relatively stern guardian of the sanctity of credit,” he said, and this was not universally applauded. Indeed, its 20-year charter was not renewed.

The disastrous financial consequences of the War of 1812 created more enthusiasm for a central bank, however, so the Second Bank of the United States was established with a 20 year charter. Nicholas Biddle, its president, was an “arrogant and difficult political personality,” Mussa said, but he eased credit as the time came to decide whether his bank’s charter should be renewed. Despite his efforts, President Andrew Jackson disliked the Second Bank of the United States and vetoed legislation rechartering it. Congress then censured the President – “the only time this has happened,” Mussa noted, but it couldn’t override the President’s veto.

As the bank faded from the scene, there was a massive credit expansion in the US, according to Mussa. This financed substantial infrastructure building but also land speculation, and it ended with the Panic of 1837, which ushered in the deepest recession of the pre-Civil War period.

Mussa said the period after the end of the Second Bank of the United States was characterized by “imprudent behavior in the private sector” that was “facilitated by

monetary and credit authorities” and “enhanced by a political system which favored a credit boom.” Mussa said this combination has continued to be visible at many times and in many countries.

To illustrate that point, he displayed the day’s *Financial Times*. The front page was dominated by stories about the Tsunami in Asia, and Mussa said it demonstrated “the difficulties in assessing risks associated with relatively rare events.” Mussa noted another *FT* article dealt with the withdrawal of Vioxx and the issues raised about drug safety. Mussa noted that the article said an FDA employee had been dismissed for saying that FDA officials had ignored concerns about this drug. Mussa added that US government officials had also neglected the problems facing the savings and loan associations two decades ago, and Japanese officials had denied the severity of the loan problems facing Japanese banks in the 1990s.

Another *Financial Times* article Mussa cited dealt with the need to change US pension fund rules. Airlines and other troubled companies were not properly funding their defined benefit plans, threatening to dump substantial liabilities in the lap of the Pension Benefit Guaranty Corp. Mussa said this tale showed “the same dynamics as the S&L crisis.”

In another article, one accounting firm accused another of withholding information about Parmalat that might have made it possible to detect fraud and thievery at that company. And yet another article detailed the plans for the trial of Richard Schrushy for his malfeasance as CEO of Health South. “The desire of the government to push people into HMOs in the 1990s is partly responsible for the types of problems that developed here,” Mussa said. Still other stories in the newspaper dealt with the debt problems facing Asian companies and countries and the accounting controversy enveloping Fannie Mae.

Mussa noted that Fannie Mae’s questionable actions did not take place in “a situation where the house market was going to hell in a hand basket.” Rather, the issue was the proper valuation of billions of dollars worth of complex derivative contracts. Mussa said this problem was bound up with the vast amount of leverage in the financial system and the concentration of counterparties. He warned that financial institutions that believe they are “too big to fail” can take on risks that endanger them and the financial system as well.

According to Mussa, even if periodic financial market crises were constrained, they could threaten the equity position of several financial institutions. He asked whether financial markets are “pricing in risks of this kind of tsunami.” He expressed concern that regulators and market participants may not know the precise size of the risks that they are facing.

One member of the audience asked Mussa if Fannie Mae’s problems were “evidence of failure of accounting traditions to deal with risk properly.” Mussa said that accounting for the value of derivatives at any point in time “is exceedingly complicated.” Even now, he said, he “is not persuaded that we really know if there is a \$9 BN loss that wasn’t recorded,” as is alleged, or if Fannie Mae’s financial results can and should be interpreted differently.

2. Roundtable 1:

The Known, the Unknown, and the Unknowable in Financial Policymaking

Charles Goodhart, Chair

*Norman Sosnow Professor of Banking and Finance, and
Deputy Director, Financial Markets Group
London School of Economics*

Sir Andrew Crockett, President,
JP Morgan Chase International

Donald Kohn, Member,
Board of Governors of the Federal Reserve System

Anthony Santomero, President,
Federal Reserve Bank of Philadelphia

Sir Andrew Crockett noted that researchers had “made great strides” in advancing knowledge about managing financial risks, but nonetheless, they “haven’t eliminated the unknown and unknowable.” In fact, Crockett said, these advances in knowledge have made it “more important to know what we know and what we don’t.” He said there are a number of settings in which statistical relationships are well known, but what remains unknown is “the outcome on any given occasion.” And what is also unknowable is how statistical relationships and correlations “will change over time.”

Crockett, who was formerly General Manager of the Bank for International Settlement, and a senior executive at the Bank of England, and the IMF, said financial policymakers are essentially “in the business of promoting financial and monetary stability.” As a result, they are deeply interested in both the risks to which financial institutions are exposed and the ways in which financial shocks reverberate through the system. In recent years, he argued, financial institutions have been increasingly successful in quantifying the risks they face. The ratio of unexpected to expected losses has come down significantly, permitting financial institutions to hold less capital. While statistical analyses can help determine the probability of “tail events,” he noted that they “happen more often than many expect,” and regulators want to be sure that banks can survive such extreme events.

Crockett warned that the past is not an adequate predictor of the future, and historical relationships break down in times of market stress. As a result, he said, “stress testing is as much an art as a science.” He added that many banks use similar risk models, and this can lead to a convergence in thought and action, resulting, for example, in many institutions seeking greater liquidity at the same moment. This may only deepen an emerging crisis.

Crockett went on to note that there are “a range of events that are unknowable,” including terrorism and large scale natural disasters. Nonetheless, the goal of regulators is to provide the system with the resilience to withstand “a range of bad outcomes.”

Crockett pointed out that the roster of things that are known and unknown can be altered by use of cost-benefit analyses: There are some things that could be known, but the costs of knowing them may exceed the potential benefits.

According to Crockett, banking regulators can impose regulations that can have counterproductive effects by driving activity to other jurisdictions. “History may be the best guide to the future,” but he emphasized that it isn’t the future.

Donald Kohn, a member of the Board of Governors of the Federal Reserve System, said that central banks inevitably “must make decisions” in the face of incomplete information. And their decisions must not only deal with monetary policy but also with the management of financial crises or “tail events.” One policy objective is to “reduce the odds of crises,” he said, adding that “an ounce of prevention is worth many pounds of cure.” The dilemma facing regulators, however, is that the more open and flexible a financial system is, the more it is open to risks as well.

Kohn acknowledged that policy responses to crises that bail out troubled institutions “can create a moral hazard and weaken market discipline.” Consequently, he said, the most attractive approaches are often those that work through the entire market, such as open market operations, to improve market liquidity. Kohn also said there are symbolic elements in central bank policies; changing monetary policy, for example, can demonstrate that the central bank “sees the seriousness of a problem,” and this “bolsters confidence” in the market. He added that central banks must be sure that moral suasion isn’t seen as coercion.

According to Kohn, in examining potential market disruptions, it is important not only to determine the “size and breadth” of these disruptions but also to determine “who are the counterparties” and “how long are the disruptions likely to last.” A financial system is better able to withstand shocks when it is good shape to begin with, he added.

Making these determinations requires a great deal of information, he said, adding that “Those in crisis management must push back the frontiers of the unknown before a crisis hits.” Even then, he said, “Each instance of financial instability is different.”

Kohn said that a free flow of information is critical to extending the boundaries of what is known. Toward this end, he noted that the Fed has not only sought to understand how US markets work, it has also sought to build bilateral relations with central bankers in other countries.

Market participants tend to react harshly when they feel stressed by a lack of information. In such moments, they seek to increase their holdings of safe and liquid assets. Kohn lamented that “much desirable information is unknowable.” But he said that the evolution of financial markets has created certain instruments that have made the markets more resilient. Internationalization, for example, has broadened the base of risks, while

derivatives have facilitated better risk management. In recent years, he said, financial markets have come through stressful periods with limited damage because of increased diversification of risk and improved risk management systems as well as stronger capital bases. He applauded institutions for managing risk on an increasingly integrated basis.

But Kohn warned that “no institution can be too big to fail.” While imposing the costs of failure on managers and shareholders may be difficult, he said this is something that regulators must be prepared to do for the good of the market. Nonetheless, the growing complexity of institutions” has “elevated” the goal of avoiding crises rather than simply managing them, he said.

Anthony Santomero of the Federal Reserve Bank of Philadelphia said the dividing line between what is known and unknown “is not a static line – what is unknown can become known.” The real dilemmas, he said, had to do with things that have seemed unknowable.

Santomero noted that imposing regulations on realms with many “unkowns” being with imposing underwriting standards, which eliminates known risks. But he warned that “sometimes we call things known that aren’t,” and this can create problems. For example, institutions may be regulated by structuring capital requirements based on loss rates. But this can lead to problems when the regulatory framework doesn’t fit the structure of the banks because there is an asymmetry of information.

He explained that when regulators are building a model of risk for various assets, they don’t have all the necessary information, so they must ask institutions to provide the information needed to validate the models these institutions are using. “At the end of the day,” he added, the models an institution uses are theirs, not the regulators, “but regulators must feel comfortable with them.”

Moving from the unknown to the unknowable, Santomero said the latter is often the realm of operational risks. The question for banking regulators is whether to require large amounts of capital to provide protection against these risks. He noted that insurance concepts “have a lot to say about this.” Insurance companies are familiar with short- and long-tailed risks, and for insurers some of these risks are desirable to retain and some are not.

For banking, he went on, the response to unknowable variables has been to “add an extra layer of regulation,” but he warned that “there is a flip side” to this: Increasing the regulatory burden adds a “dead weight” to a financial institution’s operating costs, and “this can lead to inefficiencies and circumvention of underlying regulations.” Like Crockett, Kohn warned that excessive regulation can be counterproductive by driving activities to other jurisdictions.

One member of the audience asked if understating risks leads institutions to hold less capital or to take on more risk with the same amount of capital. Santomero said that if an institution truly has “a better handle on risk,” it can “take on more risk yet be less risky.”

3. Roundtable 2:

The Known, the Unknown, and the Unknowable in Banking

Richard Herring, Chair
Jacob Safra Professor of International Banking
The Wharton School
University of Pennsylvania

Geoffrey T. Boisi
Former Vice Chairman
JP Morgan Chase & Co.

H. Rodgin Cohen, Esq.
Managing Partner
Sullivan & Cromwell LLP

Charles S. Sanford
Former Chairman and CEO
Bankers Trust Co.

Geoffrey T. Boisi, a former Vice Chairman of JP Morgan Chase & Co., said his experience in creating the Beacon Group, an investment banking boutique, could serve as a case study on decision-making in the context of uncertainty and unknowns. He argued that there are few areas of finance in which there is greater uncertainty than operating as an entrepreneurial venture investor and dealmaker.

Boisi noted that in the early 1990s, several years after retiring as a partner at Goldman, Sachs, he was running a nonprofit organization while becoming “a quintessential high net worth investor.” He felt there weren’t enough good investment advisors offering an open architecture approach across markets. “I thought I saw a hole in the market and a significant business opportunity,” Boisi said. Meanwhile, several former Goldman colleagues had approached him about making energy investments using derivatives for protection. And in addition, several executives of middle market companies “were asking me to offer merger and acquisition advice because the larger investment banks were moving away from these kinds of relationships.”

This conjunction of events led Boisi to create the Beacon Group to provide wealth management and investment banking services for businesses and wealthy families. The firm was to have three independent but complementary businesses staffed by experienced people who knew the markets well, and they were to be joined by “the best young talent in the marketplace,” he said. To motivate everybody, Boisi created a partnership structure which offered relatively low current salaries but substantial shares in the firm’s upside, “so they were locked in” and driven toward long-term thinking.

“We ended up raising largest private equity fund at that time – \$700 MM,” he said, and this was followed by an \$800 MM fund and then \$300 MM for technology. The firm created a burgeoning middle market M&A business and a money management business.

After moving along nicely for a seven-year period, at the end of the 1990s, he said, “We ended up hitting the worst energy market in 50 years, and the technology bubble burst.” In addition, the firm experienced “a change in the mindset of principal partners.” He explained that Beacon had brought in several people from Goldman, Sachs, and when that firm went public, “it changed the motivational mindset of people in our small firm – they were looking for quicker liquidity.”

Beacon had been approached by many companies seeking to invest in the firm. It had a relationship with Chase Manhattan Bank, and, in fact, Beacon had suggested that Chase merge with JP Morgan. After that merger occurred, Beacon merged with JP Morgan Chase.

Despite facing everything from a recession to the death of key employees, Boisi said, “we created value – in seven years we created a company worth \$650 MM.” Despite building meaningful market share in every major market in which it sought to compete, Boisi said, “Although we were financially successful, as Beacon and with JP Morgan Chase, we didn’t accomplish all the goals we had.”

One major problem, Boisi said, was the inability to transfer Beacon’s decision-making style to its immense new parent. At Beacon he said, the approach was “to get the smartest people in a room who have judgment and accountability for a decision. In our firm, we all had our capital on the line.” But he could not alter the more bureaucratic culture he found at JP Morgan Chase.

Managers must inevitably deal with a vast range of unknowns, Boisi said, adding, “I don’t think you can develop mathematical tool, it always gets back to judgment and character.”

Rodgin Cohen of Sullivan & Cromwell focused his remarks on the current financial regulatory environment: “What is known today is that the regulatory environment has become far more stringent,” he said. “What is unknown is the impact,” he added, and the unknowable element is “the impact of this environment on individual institutions because of the randomness of the approach.”

Cohen explained that banking institutions are not only subject to thousands of pages of regulations but also to “a multiplicity of banking regulators” and what he called “the criminalization of banking law.” Until recently, violations of banking laws were subject to investigation and enforcement by the FBI and the Treasury Department, Cohen said, but “now many law enforcement types are involved.”

Regulators have become increasingly concerned about bank secrecy because of concern that criminals and terrorists use the banking system, he noted. But as a result, banks are being examined by SWAT teams focused on money laundering with a limited knowledge of banking. Consequently, banks are not able to develop the relationships and trust they had created with regular examiners.

The impact of this change on banks and their investors include the potential for large fines and severe sanctions. An enforcement order is likely to lead to ban on acquisitions

for a period of time, and this can be particularly harmful because of the ongoing consolidation of the banking industry. He noted that several banks have narrowly avoided criminal prosecution, but if the Department of Justice “takes one more step and insists on a guilty plea, it is not clear a banking organization can survive. A conviction for money laundering can lead to death penalty for a bank” because it would lose its Federal deposit insurance. Cohen insisted he is “not being a Cassandra or a Chicken Little,” adding that there are major banks that may well be facing indictment.

There are a number of legal and regulatory actions against banks bound up in the Enron case, as well as massive private litigation. He said the settlement costs of the Enron litigation will reach billions of dollars.

In making decisions, Cohen said, banks are “data rich and information poor.” They have huge warehouses filled with currency transaction reports gathering dust, yet regulators haven’t developed the software to analyze these reports on a real-time basis.

One of the unknowns facing banks is the impact of the regulatory environment on the industry, he said, adding that as the second Bush Administration takes office, a number of key regulatory positions “will need to be filled or are rumored to be needing to be filled.” Under the current regulatory regime, Cohen warned, “a banker can go to jail if he’s got a customer engaged in tax evasion.” If that remains the case, he said, the risks in private banking would increase exponentially.

Cohen said he was particularly troubled because violations are inevitable, yet there appears to be a randomness in the regulatory process. This puts banks at great risk, he said, because “all it takes is substantial negative publicity, a Congressional inquiry, or an over-zealous US attorney,” and a bank’s future can be significantly impaired.

Cohen argued that 100% regulatory compliance is nearly impossible, so in the absence of clearly-stated prior regulatory criticism, remedies should be less than draconian. Indeed, he argued, if a bank employee acts improperly, in certain cases, the punishment should be directed at that individual instead of the organization.

The third speaker in this session, Charles S. Sanford, the former chairman of Bankers Trust, said the CEO “should be the principal risk manager” at a financial institution. In his experience as CEO of a major bank, he noted, “Usually when a problem got to me, the known and unknowable were there and the CEO had to put it together.” Things were inevitably worse than they were initially described, he said, adding, “if someone came to me with a loan problem,” he would double the potential losses that were envisioned. “My conclusion is that we rely too much on what we think we know,” Sanford said, adding, “We should always be more skeptical than we are.”

Sanford added that many executives don’t really want free markets; rather they want what he called “political markets, dominated by regulation” and often tilted in their favor. In the financial world, he noted that he had opposed the Glass Steagall Act for many years, but other bankers and investment bankers favored its continuation even though they knew it “distorted markets.”

Sanford also saw numerous market distortions resulting from the failure to mark certain assets to market. This sometimes reflected external pressures, he said, adding that the State Department might not want a bank to rate Ecuador differently than France. Yet these credits should be viewed differently just as Ford should be viewed differently than General Motors, he contended. Sanford noted that the RORAC risk management system developed at Bankers Trust was closely watched by then-Federal Reserve Chairman Paul Volcker as well as by other banks.

Sanford went on to comment on what he called “unevenness in the application of technology.” He argued that technology “lets us transform a stream of data into information and has allowed for sophisticated derivatives.” He insisted that the problems institutions have had with derivatives have largely grown out of credit problems, and he reiterated that it is impossible to grasp the true financial conditions in many settings when assets are not marked to market.

He cited the Ford Motor Company as an example. “I went to them and said how are you putting all this aluminum in cars long after buy it, since there are large fluctuation in aluminum prices?” Similarly he told Mobil Oil that it was buying oil at one price and selling it at another without noting the price changes on its financial statement. “But they preferred to retain existing accounting practices,” he said.

Sanford said that risk managers should constantly be monitoring market conditions because these are constantly in flux. He argued that the movement away from Keynesianism to monetarism “wiped out a generation of traders” because they couldn’t get used to new paradigm, and double digit inflation wiped out another group of traders in the 1970s.

As another example of people unwilling to let go of ideas they “know” to be true, Sanford said the head of trading at a large investment bank said the Federal government would never allow CD rates to go over seven percent so he sold \$750 MM worth – and rates went to 11-12% in September of that year. He described his source as someone who was “not in touch with that reality” even though he had a great record before that.

In Sanford’s view, “there is truth in data,” but an observer “may not get it” for a variety of reasons, including “extraneous developments in your personal life.”

Today’s financial market participants may be facing yet another change in the operative paradigm, he said. “Are we on a war footing with unlimited lines of credit?” he asked, noting that Federal authorities say deficits don’t matter. “If you’re running an operation now, you need to think is that the environment we’re in,” he said. Sanford noted that at Bankers Trust management had created trading simulations as a way of choosing people to hire. While there were problems with this approach, nonetheless Sanford said traders ought to adopt the practice of airline pilots, where “once a year you go sit in a simulator and make sure you’re up to speed.”

Sanford went on to emphasize the value of intuition. He noted that when John Maynard Keynes was at a beauty contest, he noted that in order to guess the winners, you need “a gut feel of what the judges like,” not just what you like. Similarly, he said, if a senior

executive “can’t walk through your trading department and tell who is making money,” that executive needs to find another job.

Market participants need to blend elements of the rational and non-rational. “Our number one best place to get traders was advertising in chess newspapers – they were our best traders,” Sanford said.

In 1987, he went on, “one of our guys came to me and said Nippon Telephone is having the biggest IPO in history.” He added, “You know how Japan is; it has to do well.” This meant Japanese institutions would be selling other stocks to raise funds to buy Nippon Telephone shares, and this would push down the Japanese market. Based on this insight, Sanford recalled, “We shorted the market and did well.”

While open to taking risks, Sanford said Bankers Trust was “always over-capitalized, over-reserved, because we wanted to have that ready so that if world comes to an end, you’re going to be the only one on the beach.”

Sanford also offered a view on compensation structures that would be heard throughout the conference: “People do what they’re paid to do.” He limited the use of stock options but doled out stock to employees – and made them keep it for three years after they left the company. This helped ensure a long term approach. Sanford spoke disparagingly of what he called “free agency,” i.e. “people moving back and forth between firms and jobs. “No matter what they did – they could blow up firm – and get a higher wage; that would scare me to death; they’re not tied into your firm.”

Because CEOs want to expand the realm of the known, he said, they are eager to create oligopolies. But he warned that this had the potential to create its own unknowns.

Sanford’s last point was the importance of innovation in expanding what was known, because “if you innovate, you control your environment, competition follows you and for a period you’re a winner by default.” He argued that innovation is normally guided by a combination of gut feel and rational calculations.

During the question period, one member of the audience asked Cohen what he would advise a banking client that was being asked to take over another bank which had gotten into trouble. “The answer is easier than one might imagine,” Cohen said, adding that it is the Fed’s responsibility to live by its word, and if it told a would-be acquirer that it would offer a period of time to correct problems in the target bank, then he would endorse the acquisition. When asked if he had the same level of trust in the SEC, Cohen that this regulatory agency has less “institutional uniformity” than the Fed, and more changes in the individuals involved.

Professor Herring noted that Boisi and Sanford had both emphasized the importance of personalities, and he said a “robust risk management system has to take cognizance of that.” He asked Boisi if it was easier to deal with personality quirks in a smaller company, and Boisi said that Goldman Sachs was a partnership where all the partners had their own capital at risk. “If there was a disagreement, we took it to the management committee,” and it got resolved, he said. At Chase, and then JP Morgan Chase, he said,

he was surprised that the head of a line of business involved in a debate was often not at the table when those issues were discussed. “I could never find who was responsible,” he complained.

Sanford said Bankers Trust tried to “mimic” the Goldman Sachs model by making sure senior people had a substantial personal financial stake in the organization.

In response to comments about the regulatory outlook, Cohen said the debate over contingent commissions in the insurance industry, “will beat the record in mutual funds in terms of litigation.” He said there are number of well-known financial practices that are now getting a second look from regulators. He warned against “the sin of incrementalism,” in which institutions move one step at a time, “until an activity once considered questionable becomes common practice.” As questions are raised in financial services, he said, “a lot of financial institutions are taking a long hard look at what they’ve been doing.”

Boisi was asked if he thought commercial banking and investment banking are compatible under the same roof, and he said, “I was trying to test that, and one reason we were willing to align ourselves with Chase was they had aspirations of developing the kind of partnership culture we found at Goldman, Sachs.” But Boisi said he found that difficult to achieve. Nonetheless, he said, “I don’t think they’re fundamentally incompatible. It depends on the leadership. I thought I had gotten into a situation where there was a commitment to do that. But it became clear to me that commitment wasn’t there.”

Sanford said he was able to develop an entrepreneurial culture inside Bankers Trust, and added, “I still believe it can be done.” Like Boisi, he said, “It all comes back to the commitment of the leadership.” Sanford reiterated that people do what they believe they are being paid to do, and that reality can be put to work in changing their attitudes and aspirations.

In closing the session, Cohen said, “Be careful of what you think you know because you don’t know.” In the fall of 1987, he said, there was a meeting of senior officials in Washington because of concern about a major financial institution collapsing because of a big US government bond portfolio. While waiting to make a public disclosure of these issues, however, “the stock market tanked and Treasuries rallied and brought the bank back to solvency.”

4. Roundtable 3:

The Known, the Unknown, and the Unknowable in Venture Capital

Andrew Metrick, Chair
Professor of Finance
The Wharton School
University of Pennsylvania

Mark Chandler
Vice President and Global Director
BTG Ventures

Brenda Gavin
Managing Partner
Quaker BioVentures

Stan Raatz
Managing Director and General Partner
Warburg Pincus

Professor Andrew Metrick of the Wharton School asked his panelists to consider two issues – how they assess commercial opportunities for a technology that is not currently in the market. And, secondly, in their role as financial managers, how they ponder risk in their portfolios? Do they, for example, think in terms of managing risks, or do they view that as the job of the investors who are giving them the money?

Brenda Gavin of Quaker BioVentures said it is “very hard to make generalizations about venture capital because every firm has its own personality.” Because of the importance of personalities, in fact, she said that when her firm syndicates deals, “the second question we ask, after, ‘do we like this deal?’ is, ‘who is going to be our syndicate partner?’”

She noted that venture capital is “really Finance 101 – what we do is buy low and sell high. It’s simple. There are no derivatives. The difficult part is determining if the price is low and is right.”

Gavin explained that her firm was formed by three individuals who had experience in the life sciences and saw an opportunity to focus on investing in life sciences companies in the Mid-Atlantic region in the belief that a geographical concentration would be efficient and effective. The founders “came out of operations so we felt we could offer a company something besides money.”

According to Gavin, the “known” risks in VC investing include an array of technical risks. “In our case, it’s all life science so the question is: Does the stuff work?” she said, adding, “at a minimum we like to see animal studies already done. We prefer human

clinical studies.” She went on to note, “Typically we don’t like the professor with a business plan under his arm. I don’t want to pay for anybody’s education.”

A second major risk area is intellectual property rights. “We have to have unassailable patents, if there is such a thing,” she said. “You may think you’ve done all the research, and some little patent will turn up that will impair your ability to operate.”

Then there is market risk: during the Internet bubble, Gavin said, “We would have people come in and try to pitch us because they had ‘net applications,’ and we couldn’t figure out the product or customer.” By contrast, in life sciences generally the market is pretty clear. The biggest question to be asked is not whether there is a market but is there going to be reimbursement by insurance companies? And is there a distinguishing factor that will lead doctor to prescribe this over something else?

There are also regulatory risks, and in this context, she said: “I see the FDA as a friend, not an enemy.” By contrast, Gavin emphasized the issue of management risks. Individual inventors and entrepreneurs are critical in this arena, and inevitably egos and personalities are also important. Thus, she said some elements of investment analysis are “almost gossip – Is he gaining too much weight? Does he drink too much?”

There are a whole set of risks that are unknown and unknowable, she added. One of the things “we can’t predict are things going on in government,” Gavin said. For example, early in the Clinton Administration, there were prospects for significant changes in healthcare policies. These kinds of risks are managed with “serious due diligence,” she said, and this is underpinned by broad knowledge of the industry that comes both from experience in it and a broad network of contacts.

Another aspect of managing risk is ensuring that the portfolio is diversified. That means investing in companies in various stages of development as well as companies focused on different therapeutic areas and different kinds of products, including drugs, diagnostics, and various kinds of devices. Gavin also seeks to modulate risk by syndicating deals. Besides raising additional money, syndication is useful because “it’s important to have more heads around the table,” she said, in order to expand the range of strategic thinking.

Mark Chandler explained that BTG Ventures, which is listed on the London Stock Exchange, invests in a broad range of technologies including life and physical sciences. It is not only involved in venture capital but also in acquiring and licensing technologies. “We are brokers of risk,” Chandler said: The firm seeks risk “that we can identify and manage better than others, and we take them.” The firm, which formed its first fund in 1999, has “an appetite for high risk,” and, indeed, when those risks are reduced, the firm is ready to sell its holdings.

While there are certainly financial risks associated with BTG investments, Chandler said the major concerns are operational risks. The principal concerns are assessing the size of the market for the proposed product and the competition. He also emphasized the importance of intellectual property risks, and noted that his organization had a sizable staff of patent attorneys. He added, “We will mitigate intellectual property risk by structuring a deal where if the company goes belly up, we will have rights to intellectual

property.” The firm vigorously enforces patent rights, and it sometimes syndicates its litigation claims just as it syndicates some of its investments.

He noted that BTG also faces technical risks: “Can the company make what they say they can make?” And there is the exit risk: “Can we get some money out of this company in a reasonable period of time?”

Chandler added that part of his work entails assessing whether a management team can work together. Almost every time you form a technology-based company, we put in a clause that the CEO will step down and become CTO at some point in time,” he pointed out. In Chandler’s view, the people who launched technology companies are usually “brilliant people,” but also “quirky.” He noted that his 1999 fund has invested in 14 companies and in seven of them, the founder is no longer involved. Once an investment has been made, he said noted that BTG continues to closely monitor portfolio companies, “and since we are publicly traded, we must take a formal approach to risk management.

Chandler said the major unknowable elements in BTG’s investment process are market forces. For example, BTG formed an electronics firm in 2000 only to find the high tech bubble burst in 2001. At that point, BTG brought in a half-dozen experts and undertook a strategic redirection of this company. As a result, the company “survived that thunderbolt” and went on to another round of financing which was oversubscribed, he said, adding that the CEO also stepped down and became vice-chairman.

Stan Raatz of Warburg Pincus said his firm ran a larger fund than the two previous speakers, and as a result, it puts a premium on spreading its risks. “This is a very conscious policy of the firm; we call it a flexible allocation of capital,” he said. The firm diversifies its investments geographically, operating out of eight offices around the world. And it also diversifies by stage of development, working across the spectrum from startups to late stage LBOs.

Warburg has the ability to move funds around, like a fund of funds, and staff compensation is tied to the overall results rather than to an individual’s specific area of activity. One downside of this broad range of investments, according to Raatz, is that the fund of fund managers must be persuaded that Warburg can do a better job than a series of narrowly-defined funds.

Raatz said every group at Warburg has a different way of assessing what is known and unknown in its arena. The energy group, for example, takes a relatively quantitative approach to evaluating investments, he said while “in biotech, our guy is bottom fishing.”

Generally, however, the goal is to find a significant gap in the market, identify a management team, and then pursue a core technology. Raatz said, “It was one of most disturbing-thing for me to learn: that good technology is so prevalent and so abundant, you can just trip over it – at least in information technology area.”

Nonetheless, he did not downplay the risks of investing in technology: I think 15% is really successful as an investment, and another 15% you get your money back. But 70% is just a total loss, and that is a huge waste.” In the energy group, he noted, “They never

have a total loss; and the LBO group better never have a total loss. But in our field, technology, we have more losers than winners.”

In response to a question about the cycles in raising funds, Raatz said there was currently too much equity capital going into private equity and too much liquidity in that area. He also saw too much money going into LBOs and hedge funds. This has made for a very Darwinian marketplace, Raatz said, adding, “If you go to a limited partner, and you’re not a top quartile, you don’t get more money.”

A member of the audience asked whether what other people were doing was one of the unknowns in venture capital investing. Gavin said that in the world of pharmaceuticals “patents are everything,” and by monitoring patent applications an investor can know what’s going on elsewhere.

Another member of the audience noted that many firms that seek venture funding end up doing something fairly different than what they originally proposed. “How do you judge a firm that proposes A but will end up doing B? Not to worry, Raatz said: “I always assume what he will be selling five years from now will not be the same. You just have to have confidence that management is flexible enough to respond to the market.” Chandler agreed, saying, “this is the best way to manage risk.”

In closing the session, Gavin said that several attributes are important in bringing knowledge to bear on venture capital investments, not the least of which is the age of the investment managers: “We’re not spring chickens; we’ve been doing it a long time, and that helps an amazing amount. You know a lot of people in your space.”

5. Roundtable 4:

The Known, the Unknown, and the Unknowable in Insurance and Reinsurance

Neil Doherty

*Frederick H. Ecker Professor of Insurance and Risk Management
The Wharton School
University of Pennsylvania*

Brian Duperreault

*Chairman
ACE Limited*

Hemant Shah

*CEO
Risk Management Solutions*

Ralph Verni

*Former President and CEO
State Street Research and Management*

Professor Neil Doherty of the Wharton School set the scene for this session by noting that risk is a “byproduct” of other financial services, but it is “the essence” of insurance.

Ralph Verni, who had been a senior insurance industry executive before joining Street Research and Management, said he couldn’t recall examples of things that were “unknowable,” but there were numerous cases where management “should have known.” He said that mortality was a key variable for the life insurance industry, but many attempts to model mortality patterns and stress test them resulted in only a “vague” knowledge of what was going to happen. He went on to cite a number of unexpected investment management risks that the insurance industry had confronted.

One was presented by GICs. These guaranteed investment contracts “seemed like nirvana” to many insurance companies, Verni recalled. Originally marketed as a certificate of deposit wrapped in an annuity contract to provide a tax benefit, it would evolve into a product for savings plans and defined contribution plans.

However, GIC contracts often included a short term investment option, and in the early 1970s, there was an inverted yield curve, so substantial amounts of money moved to these short term investment options. But insurance companies had typically invested the funds placed in GICs in highly illiquid long term investments, including private placements, commercial and agricultural mortgages, and real estate equities. At this time, he added, “the insurance industry had a “complete buy and hold mentality.”

The rapid shift in interest rates caused “quite a run on the bank,” he noted, and the industry solved its liquidity provides with “a Ponzi solution.” Rather than liquidating

investments, which would have hurt their statutory reserves, they used money from newly-sold GICs to pay for returns on existing GICs.

In a second crisis, also involving GICs, the insurance industry chose to fund some of these contracts with mortgage pass-through securities. These initially seemed to solve the problem of safety and duration matching, but the industry didn't anticipate that rates would decline significantly and duration would change dramatically because of the convexity of these instruments. As a result, the industry suddenly had "this hugely mismatched portfolio" and several companies had to take large write-offs and exit this business, Verni said.

Moving on to another example, Verni said that whole life policies had always seemed highly secure to insurance companies, but they forgot the risks associated with the policy provisions offering policyholders loans at low fixed rates. Once again, there was an inverted yield curve and insurers had to come up with vast sums to lend to policyholders at interest rates of three or four percent. Before this happened, he said, insurers seemed unaware that many of these contract provisions were essentially huge options that had not been explicitly priced but simply given to contract holders.

To add to this problem, many insurance companies found their general agents were advising their clients to borrow money on their policies in order to buy more insurance, "so they were aiding and abetting the problem," Verni said. If the insurers liquidated assets to fund these policy loans, they would have to take a huge realized loss, and that was unacceptable given their low surplus ratios of five to six percent, he said.

Turning to yet another surprise, Verni noted that the industry created universal life policies which linked inexpensive term insurance with a savings option and offered customers great flexibility in determining how much they would put into their insurance policy. As this attracted a substantial amount of money, however, insurance companies used an average book rate for pricing. But a whole new class of insurance companies emerged, most notably Executive Life, which offered high returns on universal life policies by backing them with junk bonds. Most traditional life insurance companies would not go below investment grade bonds for their portfolios.

In order to compete, however, traditional insurance companies had to offer a high rate on their universal life policies as well. Verni said insurers faced a Hobson's choice: They could let their agents urge policyholders to surrender their policies and buy newer ones, with higher returns, from other companies, or they could up their own returns. An insurer needed about ten years of a policy being in force in order to make any money on it. Once again, the industry survived with a Ponzi approach, paying off old policy obligations with the money generated by selling new policies, he said.

Verni said the insurance company faced tough competitive pressures because there are a large number of companies and supply has exceeded demand. But the intense price

competition was made more difficult because many companies reacted without thinking through the consequences of their actions. Verni offered four pieces of advice in managing risks:

- Be skeptical
- Assume Murphy's laws are in force: If anything simply cannot go wrong, it will anyway
- If everything seems to be going well, you have obviously overlooked something
- Every solution breeds new problems

Verni said the insurance industry's compensation system exacerbated several of the industry's problems: The issue was not that people were greedy, but rather compensation was the way people measured how well they were doing their job. And the compensation system encouraged agents to pay less attention to trailing commissions from existing policies and focus on the large first year commissions – which gave them an incentive to switch people from old policies to new ones. He emphasized that the range of unknowns in the economy meant that insurance companies had to price their products for uncertainty and go through a range of “what ifs” in order to make sure they were prepared for a wide range of outcomes.

Hemant Shah of Risk Management Solutions described himself as a catastrophe modeler, and said his discipline is used by insurers to quantify catastrophic risks. Although at first glance catastrophes might seem impossible to model or predict, he argued that the industry “has come a long way” in understanding catastrophic events. Today many insurers and reinsurers use sophisticated probabilistic catastrophe models. Shah said, “I operate in the netherworld between known unknowns and unknown unknowns.” Catastrophe modelers aim to foresee every real contingency facing an insurance company even if individual events remain difficult to predict.

These stochastic events, characterized by low frequency but high consequences, are separated by decades or even hundreds of years; issues in modeling them are quite logarithmic in nature. They go beyond the lifetimes of the people involved in process. So we must understand rare events that have correlations. In the early days of catastrophic modeling in the late 1980s, modelers could be excused by limited computing horsepower, but surprises now need to be attributed to a lack of anticipatory thinking.

Shah went on to examine four ‘landmark’ catastrophes:

- The first was the Northridge, California earthquakes. The lesson here was that a few insurers had built up a dangerously large book of business in a single geographic area – Los Angeles' San Fernando Valley, and consequently they suffered enormous losses from this earthquake.

- A second catastrophe he cited was 9/11. In this case, he said, the insurance community – and the nation at large – awoke to find whole new category of catastrophic risk: no longer was catastrophic synonymous with natural disaster.
- The Atlantic basin hurricanes in 2004: Hurricane risk in Florida has been well modeled, he said, but last year there were four major storms rather than a single major storm.
- Finally, the recent Asian tsunami. This surprised the scientific community, not to mention those who had built up sizable coastal communities on the assumption that they had nothing to fear.

Shah emphasized that the catastrophic model will continue to require “a healthy measure of humility.” He said one paradigm for catastrophic modeling is the uncertainty associated with flight. The “unknown unknowns in flight are things that are not yet identified,” but they are inevitably there, and the learning curve in this field “comes at the price of near-miss incidents and occasionally a tragic disaster.” He said that risk managers in every field need to be wary of unknown unknowns and immunize against them.

He warned against setting the probability of any event at zero, because then “no amount of evidence can raise it.” For example, seismology has only recently recognized that there are blind thrust faults, which by definition are not visible. “Now that we’re aware such unmapped faults exist,” he warned, “it is necessary to assign a non-zero probability to the idea that an earthquake can occur” virtually anywhere.

In the context of terrorism, Shah said, one of the knowns is Al Qaeda’s unremitting zeal, while what is unknown is the means that they can and will employ in expressing that zeal. An “unknown unknown” is the question of whether plans for an attack are well through the pipeline and to what degree weapons of mass destruction might be involved.

“Ultimately, the challenge of catastrophic modeling is trying to anticipate perils that have yet to occur,” Shah said, adding, “what keeps me up at night is wondering what we’ve missed.” Given the possibilities of all sorts of catastrophes occurring at any time, Shah said that when he was asked about the personal characteristic that characterized an entrepreneur, one of those he listed was “naïveté.”

Brian Duperreault of ACE Limited said his company is “a big buyer of Hemant’s products – we can’t get enough models.” As an insurer, he said, “We are the guys who take the risk; we love that volatility, give it to me and get it off your hands.” The problem is that while the insurance industry “is pretty good at taking risk, we’re not good at pricing it,” he said. One reason is that “the rules change on us; we put a contract out that gets reinterpreted by the courts decades later.” As a result, there are long periods of time where “we don’t know the odds, and we don’t know if we won or lost,” he said, adding that this results in frequent adjustments to insurance company financial statements.

Duperreault explained that Ace was formed after an insurance crisis in the mid 1980s. Major US companies found they couldn’t buy coverage, so some 30 industrial companies

got together to set up Ace as a specialized insurance company based in Bermuda. It offered high excess liability and directors and officers coverage for a narrow group of clients – mainly Fortune 200 companies.

When Duperreault arrived, he said, he quickly concluded that Ace was too narrowly based. In response, “I started diversifying the company immediately,” he said. Duperreault added coverage for wind and earthquake risk as well as for satellites and airplanes. He expanded the geographic spread of risks and he got Ace involved in the Lloyds of London market.

Duperreault added that 9/11 was a defining moment for my company and the industry. “Before 9/11 we knew terrorism existed,” he said, and indeed, examples of terrorism losses included the World Trade Center itself in 1993. He noted that insurance companies had explored scenarios that included airplanes hitting the World Trade Center, “but we didn’t get the severity or complexity of risk we had taken on.” He put the World Trade Center terrorist attack in the “unknown” category, noting that the industry didn’t really expect it, and didn’t know how to respond to it. “A few guys said we have a war clause and this is an act of war,” he noted, adding, “The public relations impact of saying we might invoke war clause was devastating, no one in his right mind as a CEO would have tried to invoke the war clause.”

Since 9/11, he said, the industry has been faced with the question of whether there may be another attack of this sort coming. Duperreault said he and other insurance industry leaders went to the White House to warn that the industry couldn’t afford the risk of additional terrorist attacks. Insurers argued that they couldn’t determine the frequency or severity of such attacks and establish a price for insurance coverage, and that meant the nation faced going without terrorism coverage unless the government became involved.

The US Congress passed a terrorism relief act, and in return the industry said it would provide coverage. But he said the legislation is destined to sunset this year, so there is continuing dialogue with government officials as to the respective roles of the insurance industry and the government in insuring against the risks of terrorism.

Duperreault said that his company had a net loss of \$600 MM on the World Trade Center attacks. Overall, the industry has responded by withdrawing capacity, and ironically, “the industry that makes its living taking risks became risk-averse.”

Duperreault said that insurance resembles gambling in some respects: Like poker players, insurance company executives “don’t know the odds or if we’ve won; we sit around the table with risk takers, some of whom don’t know the risks – there are lots of dummies in my industry.” But he said he welcomes stupid competitors because “they enable us to get superior returns” on some risks.

One member of the audience asked what role the capital markets could play in “low-probability high-consequence events.” Duperreault noted that the catastrophic bond “has been around for quite a while now,” but the risk/reward ratios have not been compelling enough to attract many individual investors. These bonds also represent a relatively inefficient use of capital, he argued. The insurance industry works on the basis of

accumulating uncorrelated risks backed by the same capital base. Insurance is an efficient risk transfer mechanism which prices risk better than the capital markets. While there is no inherent reason why there can't be a capital market solution, there have been ten years of attempts with limited success, Duperreault argued.

Another member of the audience asked what the insurance industry knows about terrorism that would make a convincing case for further government assistance for this coverage. Shah said it is important to decouple the analytical argument from the political argument. The question of whether or not terrorism is an insurable risk is debatable, but politically it will come down to the wire with sunset for the existing legislation looming eleven months in the future. Duperreault added that there is a lot of lobbying taking place. Real estate and banking industry leaders have joined the insurance industry in warning that the government must maintain a role.

One member of the audience asked Duperreault why he liked underwriting catastrophic risks, given that so much about catastrophes is unknowable. He asked what decision rules or models could be used in making decisions about these risks. Duperreault said he "likes" catastrophic risk "because of how it stacks up vis-à-vis the alternative, which is pedestrian low-severity high-frequency business."

The latter offers "more competition there because it is less volatile, so it is attractive to companies who don't have to explain to shareholders why they had a bad day," he said. There is less competition in the catastrophic area and that produces a better result, although there is inevitably substantial volatility in earnings. The companies formed after Hurricane Andrew and the companies, like Ace, formed in Bermuda after 1993, that have specialized in catastrophic risks have shown good discipline and have had good returns on capital. Insurers underwriting catastrophic risks "can have a bad day versus a lifetime of mediocrity," Duperreault said.

6. Roundtable 5: The Known, the Unknown, and the Unknowable in Asset Management

Francis X. Diebold, Chair

*W.P. Carey Professor of Economics, Finance and Statistics
The Wharton School
University of Pennsylvania*

Sid Browne

*Managing Director
Goldman Sachs & Co.*

Andrew W. Lo

*Harris and Harris Group Professor and
Director, Laboratory for Financial Engineering
Sloan School of Management
Massachusetts Institute of Technology*

Myron Scholes

*Chairman, Oak Hill Platinum Partners, LLC and
Frank E. Buck Professor of Finance, Emeritus
Stanford University*

Sid Browne of Goldman, Sachs said he thinks about the three categories of knowledge under discussion as follows:

- The Known: You can model it and estimate or calibrate parameters
- The Unknown: You can model it, but you can't calibrate parameters
- The Unknowable: You can't even model it

In the world of asset management, he said the risk free rate of return is a starting point, and there are premiums offered for taking on the risks associated with various assets. Brown argued that contrary to the way some might describe this setting, "risk is more the known and return is the unknown, and the active risk is unknowable."

Browne, who is involved in managing a funds of funds that invest in hedge funds, said there are a wide range of hedge fund strategies. He went on to describe some of the issues associated with attempting to model these strategies. And he concluded that what is known and unknown can vary from strategy to strategy.

Andy Lo of MIT said that any examination of risk in the asset management industry must focus on the hedge fund industry because that is where the active risk is being taken. Hedge funds have become a focal point of regulatory scrutiny since the summer of 1998 and the Long Term Capital Management crisis. Lo said there were several lessons from that event.

One is that liquidity is an extraordinarily important risk factor. “Before, we knew it carried a premium, but we didn’t realize the accelerator affect,” he said. Another lesson is that “non-linearities are absolutely critical and fairly ubiquitous in the hedge fund industry, and in some hedge fund strategies.: Hedge fund strategies are predicated on linear models, and while they may be good approximations under some circumstances, they tend to break down “when risk hits the fan” because supposedly uncorrelated variables come together in a crisis. Yet another lesson learned from the summer of 1998 is that so called smart money is not always strong enough to impose rationality on markets.

Lo said his research indicated that the systemic risk created by hedge funds is increasingly, and “we are getting to point where another perfect storm in the financial markets is on the horizon.”

Lo argued that the biggest unknowns are not about risk but rather about people’s reaction to risk, i.e. their risk preferences. He cited a paper he wrote in which he argued that a risk management protocol must integrate prices and probabilities with investor risk preferences, and this aspect of human behavior is difficult to model.

According to Lo, research about how the human brain thinks about risk has produced unexpected conclusions. He noted that the brain is not a single organ, but rather has three fairly distinct components. There is brain stem, sitting on top of spinal chord and responsible for basic functions. Then there is the mid brain, which is responsible for emotion, social behavior, fight or flight, fear and greed. Finally the last portion of brain to develop is the cerebral cortex. This part is responsible for what we think of as uniquely human endeavor like reasoning.

When neural imaging techniques are used to see which parts of brain are active, researchers found that emotion seems to override rational thought on a fairly regular basis, so when the mid brain is stimulated, that causes the brain to shut down the cerebral cortex. Lo said this suggests the way we’ve been modeling preferences does not take into account realities. In the debate between advocates of the efficient market hypothesis and behaviorialists, Lo said, “both are right at certain times.” Precisely when and where each view holds “is the greatest unknown right now.”

Turning to the unknowable, Lo said in the case of financial risk management, two things can be identified as unknowable. One has to do with levels of leverage and risk exposures in the hedge fund industry. But the reason it is not possible to know what those are is simply that nobody has access to all the data, he argued. The second unknowable is network effects. As Lo sees it, “We think of risk as a linear phenomenon, but the fact is the way risks propagate through the marketplace is through a network.” He compared the global financial system to a cobweb with various financial entities representing nodes in the cobweb, but he said few analysts were examining the system in that fashion.

While certain things are inherently unknowable in physics, Lo insisted that additional data would turn many financial “unknowables” into “knowns.” Meanwhile, Lo said he

deals with the unknowable by diversifying and by being adaptable because “the one thing that always stays the same is markets will always change.”

From a social perspective, he went on, the way to deal with unknowable financial risks is to start collecting and analyzing more data. While challenges may seem daunting, he noted that there is organization which manages the kind of work he sees as necessary: The National Air Transportation Safety Board. Any time there is an air travel disaster, the NATSB goes out and finds the black box and publishes a report on what happened and how to prevent it from happening again. “This is something we ought to think about for financial markets,” Lo said.

Myron Scholes of Oak Hill Platinum Partners took issue with Lo’s safety board proposal, and he went on to say that those involved in asset management “need to know how you’re making money, or if you’re making money.” The problem in answering these questions is seldom insufficient knowledge but rather excessive data. “We are data-rich; it’s figuring out what information to throw away. There is too much information,” Scholes said. Scholes, a Nobel laureate, complained that attention is often redirected in response to external shocks to the financial system, and this results in knowledge being developed about new subjects or concerns. As a result, he said it is difficult to define what is truly unknowable.

Scholes said he had developed a taxonomy regarding the unknowable parts of asset management, and it has grown from four to eight major areas that “I think are crucial in understanding what we’re doing in the asset management world.” These are:

1. Capital Allocation: How do we allocate capital to the risks we are taking, to each strategy individually or to a portfolio?
2. Optimization: Risk management is not risk minimization – it is risk optimization – but what is the right trade off between risk and return?
3. Stress Management: How do we handle it, and do we know how to do anything about it?

In addition to these three, which he called “whats,” Scholes said, he had five “hows:”

1. Feedback system: How do we learn from experience in order to grow and enhance our ability?
2. Structure: How should an asset management business be organized and run, and this include compensation as well as management processes.
3. Transparency: How do we handle risks within our organization? How do we know the risks? Scholes noted that investors and regulators can know a fund’s positions and still not know anything. “Collecting data does not do you any good without a model,” he warned.

4. Capital structure: How do you handle your risks regarding your investors? Scholes said, “If I’m in an illiquid area, like private equity, am I going to let my investors cash out tomorrow?” By the same token, he asked if mutual fund are structured correctly if they are buying illiquid assets yet letting investors take their money out with one days’s notice?
5. Regulation: How does it affect the nature of a business?

Each of those areas creates an opportunity to continue to learn and to know more,” Scholes said, and went on to revisit several items on his list.

In the case of capital allocation, for example, he asked what capital is required to support various positions. Some determine this using portfolio theory, but he warned that portfolio theory relies on the stability of correlations, and on constancy in opportunity sets, and these conditions do not always prevail.

He went on to note that the idea of allocating capital to support certain strategies requires deciding whether a firm has a trader model or an investor model. In a trader model, the firm wants to allocate as little capital as possible to each strategy, Scholes said. The trader takes some amount of capital and says that if the opportunity set becomes richer, then the trader will ask for more capital. The investor model says you have some capital set aside in case of contingencies.

Scholes noted that in venture capital and private equity investing as well as trading in general, compensation is based on the capital allocated, and individuals have an incentive to minimize the amount of capital they use. When allocating capital in this fashion, “You don’t know in a dynamic sense what the optimum model is,” Scholes noted. He compared this to his relationship with his four children: “They know I’m there to support them, so as a result they take risks they wouldn’t take otherwise. In the venture capital or private equity world, if all your four children call you, you are in trouble.”

Turning from capital allocation to optimizing, Scholes said risk management is not necessarily about risk minimization but rather risk optimization. In order to make money a firm has to know where it is getting its returns, and that requires a valuation model so it can say what assets are rich or cheap. Interwoven with this is the question of what risks to assume. Scholes aid most of the asset management business is like Goldilocks and the Three Bears: Either the porridge is too cold – there is no volatility. Or the porridge is too hot and it’s hard to make any money. The porridge is seldom just right.

Scholes went on to say that stress management or risk budgeting is an area that warrants closer examination. “Are we reactive to a crisis or shock, or proactive?” he asked. There is a cost to either response. He argued that investors typically have a current account budget and capital account budget, but no risk budget; that is, they don’t calculate the costs associated with various kinds of risks.

Once investors have generalized various scenarios and determined the tradeoff, Scholes said they can choose to manage risk by buying insurance, by diversifying, or by holding

reserves. Risk budgeting can be made proactive, Scholes said, but so far this has not been done by many investors.

The panelists were asked whether the financial sector could create the kind of analytical group Lo was suggesting and really learn from crises and near misses. While Scholes expressed concern about government's ability to undertake such a task, Lo noted that the reason the NASTB works is that they don't use government employees. When there is a crash, they assemble a team of engineers from industry, many of whom have worked together before, and they're dispatched to the site. In a similar fashion, he said, forensic accountants and financial engineers could be brought together to analyze financial crises.

Brown noted that in response to the LTCM problem, various working groups had been created to analyze what had happened and to prevent it from reoccurring.

Lo was asked whether he was arguing that linear models are wrong as a basic description of economy, and he replied that "all economic models are wrong." The question is how good an approximation of economic events they provide. He said linear models are not equipped to track dynamic risk exposures.

He said hedge funds provide a significant challenges to models because many hedge funds have a beta "that looks like zero," but if that beta is disaggregated, there are asymmetric aspects, and the strategy is not a genuine zero beta strategy, "so better econometric tools would help a great deal."

Scholes added that in many investment funds, the manager chooses what risks to take, so the fund can't easily be fitted into any standard model. Moreover, the capital asset pricing model doesn't work either. "Life is linear except when its not," Brown said, and like the other speakers, he agreed that impact of hedge funds needs to be viewed as more than just a form of options.

Lo was asked why he sees what he called "a perfect storm" on the financial horizon, and he said he saw a menacing combination of higher volatility, lower returns, more illiquidity, and narrower credit spreads, "which means there's a lot of cheap money out there." In addition, he noted that a number of larger financial institutions have increased their VAR "quite significantly over the last 12 months, partly from pressure on the bottom line."

7. Closing Remarks

Paul Kleindorfer

Anheuser-Busch Professor of Management Science

The Wharton School

University of Pennsylvania

In a sweeping overview of managing in an environment in which some things are known and some inevitably aren't, Professor Paul Kleindorfer of the Wharton School said this kind of discussion dates back some 90 years to celebrated economist Frank Knight, who wrote about decision-making amid uncertainty. Kleindorfer said economists went on to spell out a variety of approaches to decision making in this kind of context.

He noted that when information is knowable, "learning and adaptation rule," but decision-makers tend to use "anthropomorphic metaphors" to explain how organizations should respond to uncertainty.

He added that even if much is known about a particular setting, "it would be a mistake" to assume "we have no epistemic risk." Epistemic risk is related to knowing and knowledge, and he added that "under conditions of large epistemic risk, legitimacy is more difficult." The decision-maker must explain how choices have been made without a widely accepted model.

Kleindorfer noted that there has been "an explosion of risk management tools available," but he warned that many of them assume that some things are unknown, but seldom unknowable. He called for an organizational environment that "at least recognizes" things that are unknowable. He emphasized the importance of marshalling all available information *ex ante* while minimizing what is unknown and unknowable.