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Risk Reduction in the New Financial Architecture: Realities, Fallacies, and Proposals

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"There is no regulatory or supervisory agency in any country, including the United States, which fully and comfortably understands, for example, how leverage is accomplished, in what volumes, with what participants and products, the nature of the collateral and the minute-to-minute shifts of positions by the players."

Eugene H. Rotberg, former Treasurer of The World Bank, reporting to clients after the 1998 Bank-Fund meetings

Mark Twain remembered from the silver mines of Nevada a grizzled prospector who set up some tent poles beside a rocky ledge and stretched a canvas between the ledge and the poles to make a shelter for his bed and his gear. A cow came ambling down the hill, stepped onto the canvas and fell in on him; and he rebuilt his lean-to and went back to bed. Another cow fell in; and he rebuilt. Again. And again. Finally he reacted: "This dangd thing," he said, "is getting monotonous."

Six times in the 1990s—in the American banking disaster of 1990-91, the failure of the European monetary grid in 1992, the unanticipated interest-rate hikes by the Federal Reserve in 1994, the Mexican collapse of 1995, the Asian disaster of 1997, and the Russian default of 1998—the world's financial structure shook and shivered, and a cow fell through the roof. "By any standard," said E. Gerald Corrigan of Goldman, Sachs, formerly president of the Federal Reserve Bank of New York, "the frequency and consequences of these events are simply too great."¹ The world's political leaders, like Mark Twain's silver miner, grew tired of the repeated experience, and went looking for something that could carry a heavier load. G-7, G-10, G-22, IMF, BIS, IIF, the finance ministries, economists and (more skeptically) the central banks have worked together to establish "a new financial architecture."

It may well be that a complete restructuring would do us good. Our discussions of financial matters have moved too far from the realities of getting and spending in real economies. Finance, which should be in the boiler room, has mounted the pulpit. Once perceived as parasitical but inescapable in a world where only partial information exists, trading in financial instruments has become the one and only yellow brick road to price discovery. We continue to use terms like "current account" and "capital account" that are meaningless in the age of the derivative. After generations of warning students against trying to compare apples and oranges, we seek algorithms to guarantee the arbitrage of quite disparate pieces of paper, from different countries (some with open economies, some with closed economies), issued at different times for different durations, carrying different promises and obligations. In the name of rational expectations, we accept volatilities that destabilize production plans and compel producers to pay the ever-growing costs of hedges that may not work when they are most needed.

Some proposals for a "new financial architecture"—especially the suggestions for restrictions on interbank lending—do indeed imply a willingness to sacrifice efficiency for congruence with a more complicated reality. Others—especially in the area of financial reporting, where honest accounting would sabotage the customs of so

many governments and banking regulators, including those in turn-of-the-millennium option-besotted America— would be desirable foundation stones whether or not we were worried about financial crises. Most of the blueprints on the table in spring 1999, however, look more like an intellectually inexpensive construction of flying buttresses to bear a previously unanticipated weight on the roof of the old building. Making the IMF into a world central bank to provide a lender of last resort, or a credit-enhancement enterprise to insure borrowings, or an omniscient rating agency, or an enforcer of currency pegs—creating instruments by which the World Bank or the development banks would lend jointly with private sector institutions, insisting that banks which overlend to developing countries take a preordained haircut if those loans go bad, insisting on new bond indentures that do not require the agreement of every holder before they can be restructured—these are not in fact structural alterations. And with the possible exception of co-lending, they are not going to happen, anyway.

There are changes that can be made to solidify the financial structure. First we had better study the incentives the cow has been given to walk on the path leading to the lean-to, and seek some way to divert her in other directions.

The State, the Markets, and the Banks

Definitions

After hearing testimony before a Congressional committee urging rule changes that would promote the use of exchange-traded rather than over-the-counter derivatives (financial instruments that derive their value from changes in the price of other financial instruments), Mark Brickell, J. P. Morgan's spokesman on such matters, warned that it is a grave intrusion on freedom to tell people how they have to do their business. But the historical fact is that markets from the fairs at Avignon to the horse auctions of Kentucky to the Singapore International Monetary Exchange are all creatures of a legal order. It is in the interaction of enterprise and law that prosperity and freedom are to be found. Without a legal order, all the world is Russia. Without a system for enforcing contracts, trade cannot flourish and pricing mechanisms cannot issue their significant signals. Without a set of laws describing the contracts that will (and will not) be enforced, the legal order will not be generally acceptable: the system serves interests more extensive and larger than those of the traders themselves. Law and regulation cannot merely *respond* to changes in the market. It is distasteful to watch the financial engineering community crying out for a "legal certainty" that will require the enforcement of even the most one-sided and abusive derivatives contracts while demanding that lawmakers must not tinker with the existing, often accidental, parameters of their markets.

The purpose of the markets for financial instruments is the efficient allocation of scarce means to alternative uses through the pricing of income streams and risks. Producers and consumers, savers and investors, exporters and importers, lenders and borrowers react to the price signals that come out of the markets, creating supply, expressing demand. But there has historically been an exception to the primacy of prices in decision-making. Lending by banks has been at fixed rates for fixed terms, with only moderate discrimination, a few hundred basis points, between the best and the clearly less-than-best borrowers. Indeed, interest rates on bank loans are influenced as much by non-economic power relationships as by risk judgments. The decision question is whether to make the loan or not, and that decision has been made on the basis of information specific to this borrower gathered by a lending officer and held proprietary by the bank—with legally enforceable covenants of secrecy. The security for the loan is only partly the cash-flow from the borrower's enterprise; frequently, the value of the borrower's assets are a major factor (and, again, the security interest can be legally "perfected" to guarantee the bank's access to them in case of default). The sense of the price of the loan is complicated by the fact that the loan is normally only one of a number of relationships between lender and borrower.

Banks are highly leveraged institutions which lend mostly other people's money. Because deposit liabilities must be paid on demand and the assets behind them are longer-dated, the leveraged nature of the bank means that even when the balance is safely positive a sudden demand for cash can break a bank, because loans or investments cannot be sold in time or can be sold in a panic atmosphere only for much less than what they are "worth." Illiquidity may occur without insolvency. The more tightly the anticipated outflows of funds are articulated with anticipated inflows, the greater the danger that a minor interruption in receipts—a mere "displacement," to use Hyman Minsky's analysis—will trigger a need to sell assets. "Market risk" emerges in

banks because their liabilities reprice before their assets reprice when interest rates change: note the American S&Ls, which were carrying mortgages that paid 6% interest when they had to pay 12% for deposits. Among the earliest and most useful of derivative instruments is the "interest rate swap," which permits institutions with floating rate liabilities to protect themselves by swapping the income stream on their fixed-rate assets for the income stream from floating-rate assets (while other institutions with fixed-rate liabilities guarantee their profits by swapping floating-rate returns for fixed-rate returns). Even so, excess leverage can produce illiquidity, which is why common sense, law, and markets (when the information is available and government don't interpose guarantees) require banks to keep a cushion of capital.

As intermediaries—agents for their customers—banks do business with each other in a banking "system." The failure of one bank, by interrupting the anticipated cash flow of other banks, may create a reverberating crisis well before the flight of depositors. If an anticipated payment is not received, a bank is thrown into the credit market at a time when that market may be hostile. Presumably, this is why the central bank has a discount window, but access to the window in the United States is a privilege rather than a right, and the modern discount window officer has been trained to be tough. When Banco do Brasil failed to pay what it owed at the New York Clearing House payments computer on December 9, 1982 (the day when the first Latin American crisis, as distinguished from a merely Mexican crisis, began), Citibank and Chemical as the responsible correspondents were left alone to rustle up the necessary \$300 million. A bank seeking to meet profit targets that can be met only by investment in low-rated or longer-term assets can become a source of "systemic risk" even though it is well-capitalized, and the Fed quite reasonably does not which to encourage such reckless behavior..

There is a literature proclaiming that "systemic risk" is a fiction created by supervisors to enhance their own power, and that they have exploited "pseudo-systemic risk" to puff up their importance. "Markets monitor risks," Anna J. Schwartz and colleagues wrote in 1996, when emerging markets were in fashion. "Investors. . . will shun entities where they perceive uncompensated risk and flock to entities with more inviting returns. Emerging stock markets are an example."² They are indeed. *Res ipse loquitur* .

Operationally, there can be little question of the validity of the Lamfalussy definition of systemic risk: "the risk that the illiquidity or failure of one institution, and its resulting inability to meet its obligations when due, will lead to the illiquidity or failure of other institutions."³ No one who lived in proximity to the Herstatt crisis of 1974, or watched the severe degradation of all markets as morning moved to noon on October 20th, 1987, could doubt the damage done to all credit-financed activity when banks become reluctant to make the payments expected from them until they see the arrival of the payments expected by them. The fear of falling dominos creates a paralytic gridlock, and the gridlock is what kills you.

Once the public senses trouble, banking regulators and supervisors will connive with bankers to convey "confidence" that the banks' liabilities are more than covered by the value of their assets. The authorities will permit continued carriage of distressed or diminished assets at their "historic cost," will ignore losses that have accrued off the balance sheet, and will provide "lender of last resort" services even when the banks are in truth no longer viable. Insolvency may be concealed by a diagnosis of illiquidity. When all else fails—when the losses of the banks exceed the seigniorage powers of the central bank—governments will be summoned to the rescue. As Andrew Sheng stressed in his study for the World Bank, the losses of a decapitalized banking system are a quasi-fiscal deficit: "bank losses greater than available bank capital are equivalent to an internal debt of the government that is being financed with short-term bank deposits."⁴ For the deposit liabilities of the banks are the currency of the country; to the extent that they are not backed by valid private assets, they become the liabilities of the state. The increase in total liabilities provokes a fall in the value of the currency, or inflation, or both.

Markets are special, too

"The question is," said Lisa Polsky, chief risk officer for Morgan Stanley Dean Witter (which came through the fires of 1998 less scorched than any of its rivals), "am I making money on the things I do every day. And how much will I lose if the less likely things happen. And how many of these things are an event of death. For me, an event of death is getting fired. For the regulator, it's systemic risk." (An officer of the Federal Reserve

notes that he gets fired, too.)

Market systems work with instruments that are easily bought and easily sold. The definition of a successful market is that it has "breadth, depth and resilience." Breadth means widespread participation, so that prices can reflect the views of a diversified community. Depth means deep pockets, so that large orders to buy or sell will not jolt markets far from what are presumably equilibrium positions. And resilience means that in the aftermath of a jolt prices will oscillate around an eventual consensus valuation rather than shoot off in one direction.

The word "liquidity" has a different significance in a market. For a bank, liquidity is simply the assured capacity to meet whatever payments may be required today. For a market, liquidity is the certainty that the system will generate a bid for an asset a participant wishes to sell. By a common fallacy of composition, the liquidity of a market tends to be measured by the volume of trading. Thus when value is segmented by breaking an instrument into different tranches that reflect different times of maturity, degrees of optionality or levels of risk, "liquidity" apparently increases, for the larger number of instruments to trade attracts a greater total volume of trading.

In fact, however, segmentation reduces liquidity by narrowing the market that is interested in the instrument. And to the extent that the markets for these instruments are related with a predicted covariance, segmentation can encourage exponentiating price movements as participants showing a loss in one sector hasten to protect against future losses by "dynamic hedging"—going with the flow—in other sectors. Nassim Taleb points out that markets for some instruments will give false signals of liquidity, because these instruments are "correlated siblings," apparently natural hedges, to a number of other instrument: "They act as a trap that will attract many hedgers and arbitrage traders then force them into noisy liquidations."⁵ In 1994, when the Fed's increase in short-term interest rates put pressure on the markets for collateralized mortgage obligations and off-the-run government bonds, the market for 10-year Treasury notes was devastated because it had to bear the weight of hedging by investors in many other instruments who couldn't sell in the usual markets for those instruments and needed a market where they could sell. (A puzzled Fed launched a special investigation of what happened to the 10-year Treasuries, because the collapse there had reverberant effects of its own.) Practitioners, as distinct from academics and mathematicians, measure liquidity not by trading volumes but by the stability of the spreads between bid and offer when a market comes under pressure.

Liquidity risk in markets may be sectoral: the stock market may be without bids while the Treasuries market swarms with activity. This can protect investors—on October 19th, 1987 the value of pension funds' bond holdings rose almost as much as the value of their stock holdings fell. But it can devastate traders who play the "convergence" of prices in cognate markets. When participants are stretched, even a delay in realizing the putative gain from a hedge can doom a player whose creditors hold him immediately responsible for his losses. Moreover, the protections offered by the central bank do not exist in the market context, where the focus is on price. The move to market valuation of assets, required in a market-dominated world, deepens a crisis. "In a time of panic," says Henry Kaufman, former research director for Salomon and now a consultant and money manager, "the last thing in the world you want to focus on is price." As the Bank of Japan has demonstrated, the supply of liquidity to banks may not help prices, because each participant may have his own reason to keep the newly injected liquidity for himself

Obviously, a banking crisis where necessary payments do not appear bears a resemblance to the market crisis where netting arrangements collapse, but the similarities are deceptive. In banking, liquidity risk is an end point of credit risk, relating to the danger that payments on a loan will not be made. In the trading context, liquidity risk is an end point of market risk, relating to the danger that asset prices will go into free fall. In the loan world, there is no market risk, because the banking supervisor will let the bank carry an asset at cost so long as the banker intends to hold it to maturity and there is reason to hope the debtor will pay off at par on maturity. In the market world, there is very little credit risk: everyone has had to put up "margin" (some required fraction of the cost) to acquire his stake, only those who can afford to pay are permitted to play, the clearing houses associated with the exchanges guarantee against default, and the question is what the future payment is worth, not whether it will be made. "In a securitized world," John Heimann, former Comptroller of the Currency and vice-chairman of Merrill Lynch warned his executive management committee in a memo in October 1998, "there is no credit watchdog."

Market risk and credit risk do intertwine in complex ways. Banks have always counted on market participants to be the residual users of the overnight call money that makes up the bulk of the banks' liquidity reserve, supplying cash especially to dealers in government securities on the chassis of the repurchase agreement—and the market, obviously, has counted on the banks to have such funds available. Today, banks securitize very large portions of their asset portfolio, and these positions are "marked to market"—valued at their traded price—every day, for internal management use if not always for public exposure. Thus market prices strongly affect banks' internally and sometimes externally perceived capital position as well as their liquidity. In the last few years, numerous derivative instruments have been created to cover market risk and credit risk together, especially "total return swaps" which on a date certain in the future will give one party the interest on a very safe instrument, plus a fee for making the plane fly, while the other party receives the earnings (plus price appreciation or depreciation) on something more adventurous, often a stock which is part of a takeover bid or a bond in an emerging market, or an index contract—or a loan to a low-rated borrower. These swaps have become the instrument of choice for "hedge funds" looking to minimize the commitment of their own cash; indeed, Janet Tavakoli, author of the textbook *Credit Derivatives*, has criticized banks and regulators for permitting total return swaps to be used as a means of leverage for funds and a dodge around capital requirements for banks.⁶

"Product risk or counterparty risk," the German banker-economist Alfred Steinherr writes, "are more difficult to assess, still more difficult to aggregate with market risk and, worse, may not be independent of market risk."⁷ In any event, control of credit risk and control of market risk are two every different disciplines, requiring different attitudes and different tools. "These things get into separate baskets because it's easier to model them separately," says Goldman's E. Gerald Corrigan, who has become co-chairman of the recently formed private-sector Counterparty Risk Management Policy Group. "You have to look at a significant drying up of market liquidity separate from the loss of liquidity in a specific instrument." Thus J. P. Morgan offers separate analytical frameworks, RiskMetrics and CreditMetrics, to keep the baskets apart.

There are cultural differences. The market risk analyst is at most a disputant, who tells the mathematical modeler and the eager trader that what they see as a "mispricing" may reflect other participants' more perspicacious judgment of factors they have failed to note or discarded as unquantifiable. In normal circumstances, the market risk analyst will influence but will not dominate traders' actions. The credit risk analyst, by contrast, sits in judgment as a superior kind of auditor who tells loan salesmen that they cannot do the business they want to do. Traders are impatient with negative ratings from credit analysts—after all, Goldman and Bear are doing business with these bozos. They are a free-standing profit center, and there is a profound asymmetry between the rewards traders enjoy for success and the penalties they suffer for failure. The mixture of credit risk control and market risk control swims against the stream of modern banking: "The nature of banking," says consultant Ed Furash, "is to create silos where people know only what *they* are doing."

Lisa Polsky at Morgan Stanley is one of very few who have operational control of the risk spectrum: "Market risk, credit risk, collateral risk, operating risk, documentation risk—all these risks are intertwined," she said in a colloquy sponsored by *Derivatives Strategy*. "If you take a silo approach to risk management at the firm level, you run the risk that, by attempting to eliminate one risk category, you pass the risk on to another category. For example, if you 'square up' market risk, you incur credit risk. . . . The bottom line is that you have to take risk to make a return. Not making an adequate return is also a risk."⁸

The world of finance had a terrible scare in fall 1998, but by April 1999 that was history. "Every month that goes by without an adverse event will increase the flow of competitive juices," said Henry Kaufman. "The power is in the people who make the money." But the risks here are not simply those of the participants. As we saw in summer 1998, a cocktail of nondeliverable forward currency contracts, knockout options and perverse hedges can raise the ghosts of systemic risk. The Working Group on Highly Leveraged Institutions of the Basle Committee on Banking Supervision noted in January 1999, "the overall cost resulting from the failure of a large HLI may not be limited to the private cost of a depreciation of investors' and creditors' assets. These broader risks cannot be disregarded by supervisors and require careful consideration of the possible policy responses."⁹

Fallacies

Easy substitution

The dangers to the world economy are more in the unquestioned intellectual foundations of the system than in the superstructure that receives the attention. The most serious is the assumption that efficiency gains from increasing the comparability and thus interchangeability of paper (reducing "substitution costs") are sufficient to justify the distortions and omissions inevitable in what the literature describes as Principal Component Analysis (PCA).¹⁰ "Paradigms gain their status," Thomas A. Kuhn wrote more than forty years ago, "because they are more successful than their competitors in solving a few problems that the group of practitioners has come to recognize as acute."¹¹ When new problems arise—when other components must be made principal—scientists scramble to save appearances until someone finds a new paradigm that fits.

The reduction of economic assets and enterprise to monetary expression, and the achievement of comparability through currency exchanges, are among the great intellectual feats of the species, with reverberant effects through the cultures of developed societies. It is true, as Roy Culpeper of the North-South Institute insists, that "The whole Asian miracle took place among countries that were highly non-liberal over three decades,"¹² and also that it's easy in the United States, coming off a decade and a half of stability and growth, to insist that the benefits of liberalization exceed the costs. But the better argument remains with the economists of the Washington Consensus. Bruce MacLaury, then president of the Brookings Institution, expressed the full flower of that consensus in his preface to one of the books in the Institution's series on *Integrating National Economies*: "Restrictions against cross-border financial transactions are almost always unwise, both for the countries that impose them and for the world as a whole. At root, financial instruments—deposits, loans, stocks, bonds, or complicated derivative contracts—are ultimately claims on real resources, goods, or services. Efforts to restrict flows of financial instruments therefore hinder exchanges of goods and services, thus impeding the transfer of resources to their best uses."¹³

The creation of abstracted instruments, moreover, may greatly improve the performance of markets for more specific instruments. The futures contract in Treasury bonds, which can be satisfied by the delivery of any Treasury bond with more than 15 years to maturity, rescued the bond market from its historic pigeonholes. Prior to the late 1970s, a price for a Treasury bond might well be determined in large part by how many bonds the Treasury had issued in a given year, and how well-stocked the insurance companies were with that maturity. There is even a case to be made for the cash-settled stock index contract that gives investors a chance to play and hedge "the market" rather than individual stocks, though the cash-settled over-the-counter unpublicized private contract breaks the link between price and supply that is the keystone of market-based decision-making.

As objects for trading, however, financial instruments are inherently one-dimensional: they have a price. The theory of easy interchange therefore rests on the assumption that at any given moment, all available information about all such instruments, even across national borders, is already present in the price. Information technology improves pricing, while "transparency" and uniform accounting standards make it possible to compare, say, bonds issued by a Korean steel mill and bonds issued by a Brazilian paper mill. In principle, one can draw an indifference line between the ownership of those two instruments even if one is denominated in won and the other in real, but the world is made easier for the investor by denominating them both in dollars. Then the computer can get to work and do an analysis of variance-covariance between the bonds of Korean enterprise and the bonds of Brazilian enterprise, arriving at a statement that at the 95% confidence level one will decline in price by somewhere between 5% and 15% if the other declines in price by 10%. "Liquidity" is created by arbitraging between two instruments that may have no relationship in the real world but show historic patterns of similar price movements. It becomes possible—in theory—to protect oneself against a continuing decline in the price of one's Korean fixed-income portfolio by selling Brazilian bonds.

These dynamic hedging activities are dangerous enough when the instruments involved are publicly traded, publicly priced, settled through clearing houses. But when the abstractions of the derivative instrument are applied to highly specific private arrangements, customized contracts between two parties, with prices unknown to the outside world (and sometimes to at least one of the participants—the Wholesale Transactions Code of Conduct approved by the Federal Reserve in 1995 forbids a customer even to seek advice from a third party on

the legitimacy of the contract offered to him)¹⁴, with no registry for "open interest" to indicate the quantities of similar instruments that are out there, the market becomes subject to shocks that cannot be anticipated. For the private contract may well be hedged in the public market—and in times of stress, when the private markets shut down, it will certainly impact on the public market. "Market risk," writes the Committee on Payment and Settlement Systems of the central banks of the Group of Ten, "is usually adjusted by buying or selling the most liquid instruments that are sensitive to changes in the relevant risk factors. These are typically exchange-traded derivatives or securities. . ."¹⁵

We are told that this improves the pricing of risk internationally, but should one ask why dynamic hedging improves the pricing of risk, the argument tends to shift to a proposal for mitigating the negative effects. If the traders who plan to sell in this market when they begin to show losses in another will only post in advance the strategy they plan to follow, all will be well: "Sunshine trades," a research group at the Bank for International Settlements reports, "should not move market prices, since they contain no new information about fundamental values. . . Market liquidity could also be improved by sunshine trading, since a lower variance of prices may make it less costly for risk-averse agents to enter the market to speculate."¹⁶

One pauses for thought. What exactly *is* a risk-averse speculator? If it is known for a fact that Hedge Fund A will sell the be-jesus out of the Brazilian market on the day the Korean market is off three per cent, won't a whole bunch of other hedge funds front-run the strategy, selling Brazil and then Korea to cash in? "Knock-out options" protect their purchaser against, say, a 10% drop (or rise) in the price of a financial instrument, but if the price moves *more* than 10%, the option self-destructs. Counterparties know about these instruments, and others can intuit their existence. Has no commentator other than George Soros noticed the frantic activity in the market for that underlying instrument as the borders are approached? That, one is told, is a separate problem, known as "coordination failure."

"[S]ystemic crises of the Asian type must be seen," David Marshall of the Federal Reserve Bank of Chicago writes, "as a problem of coordination failure among investors."¹⁷ If everyone knew that everyone would be better off if nobody tried to get out, it wouldn't be so bad. There is something to this—a veteran of the experience of the closure of Drexel remembers that the Federal Reserve Bank of New York was going to give the dealers and banks with claims on Drexel's portfolio of mortgage-backed securities the use of the Fed's gym, setting up a desk for each dealer and a desk in the middle for the clearing bank, and lock the doors until everybody had agreed on how to divvy up the assets. The intended participants called it "caveman clearing," and ultimately they were saved from the experience by Goldman, Sachs, which bought the whole portfolio. The rescue of Long Term Capital Management can be seen as a coordination success. But I fear the cow may fall through the roof again and it could be worse than monotonous.

Confusing frequency with probability

Perhaps the most damaging aspect of the oversimplification made possible by modern machinery is the belief that finance economics is a "science." Michael Lewis quotes Victor Haghani, a partner in the rescued hedge fund Long Term Capital Management: "What we did is rely on experience. And all science is based on experience. And if you're not willing to draw any conclusions from experience, you might as well sit on your hands and do nothing."¹⁸ But if there is one conclusion that can be drawn from financial markets with absolute certainty, it is that there will come a day that is not like the day before. "History teaches you modesty," says Eugene Rotberg. "Computers teach you arrogance."

"The natural man," John Maynard Keynes wrote in his *Treatise on Probability*, "is disposed to the opinion that probability is essentially connected with the inductions of experience. . . As Aristotle says, 'the probable is that which usually happens.'" Keynes cites David Hume's objections: "'The idea of cause and effect is derived from *experience* . . . When we are accustomed to see two impressions conjoined together, the appearance or idea of the one immediately carries us to the idea of the other. . . Thus all probable reasoning is nothing but a species of sensation. 'Tis not solely in poetry and music, we must follow our taste and sentiment, but likewise in philosophy.'" No amount of observation of white swans can prove that all swans are white, but a single black swan proves the contrary. Keynes concludes: "If our experience and our knowledge were complete, we should be beyond the need of the calculus of probability. And where our experience is

incomplete, we cannot hope to derive from it judgments of probability without the aid either of intuition or of some further *a priori* principle."¹⁹ George Martin of the University of Massachusetts argues that this is a little too gloomy, that the knowledge of an experienced trader is "portable," and will serve him well in other times and places, but that still doesn't make it science.

In addition to intuition and expertise—sometimes instead of either—the modern trader uses a mathematical model, which accepts experience in the form of numbers and spits out propositions. The most common quest is for arbitrage, for example, between the spot price and the forward price of a currency that is loaned at an interest rate different from that of a currency for which it can be so easily exchanged. In spring 1997, for example, interest rates on the Thai baht were into double digits, while 90-day loans of dollars were at about 6% and 90-day loans of yen were under 2%—but the forward price the baht in dollars was the same as the spot price. Thus a lender could borrow dollars at 6%, use them to buy baht, lend the baht for 90 days at 12%, and sign a forward contract entitling him to buy back his dollars at the end of the 90 days. That sort of opportunity was made possible because the central bank of Thailand was selling dollars forward for delivery in 90 days to hold up an artificially high exchange value for its currency. People can spot some such anomalies without computers—faster than a speeding bullet, Gus Levy of Goldman, Sachs did it in his head every day in the 1940s and 1950s—but others are trickier and it's always nice to have the computer do it for you.

The most important and famous of the models is the Black-Scholes equation, now more than a quarter of a century old, for pricing options on common stocks that do not pay dividends. The user pumps in the present price of the underlying instruments, the strike price of the option, the time the option is to run and the interest rate on a risk-free investment, and pumps out a statement of the cost of a set of options that replicate the value of a portfolio on the assumption that the price of each stock varies over the period according to a log-normal curve of distribution. One can deduce the market's anticipation of price volatility in this stock from the real-life, traded price of the option. One can then study statistically the actual behavior of the stock over such time periods, and from the data generate the historical probability of each price movement. Options can be used to replicate a portfolio, or hedge it, or just to trade. If the price of an option indicates market belief in upcoming volatility greater than that predicted by the model, the option is said to be "overpriced," and the trader may sell it.

The importance of the Black-Scholes algorithm is that options are embedded in or can be drawn from most financial instruments. Deposit insurance gives a bank a "put option" to sell its assets to the government at a price high enough to repay depositors. A mortgage gives the homeowner an option to pay back his loan and take a new one at a lower cost if interest rates fall. A commodities market gives the seller of futures contracts the option of delivering the commodity specified on the expiration date of the contract if he can buy it for less than he would have to pay for a cash settlement. Like all equations that have equal signs in them, the model gives analysts a chance to hold some factors constant and let others vary and see what happens. Variants of the Black-Scholes model can be used to price options on fixed income investments with a given maturity, and there are other models that weigh the correlations between the changing prices of instruments that appear to move reliably in similar or opposite directions. Thus, for example, the owner of collateralized mortgage obligations premised on an average twelve-year life for the universe of American home mortgages will hedge the risk of interest-rate swings by selling futures on the ten-year Treasury note.

Since 1988, the Bank for International Settlements in Basel, a coordinating agency for central banks, has advocated that banking supervisors require banks to allocate capital against their derivatives positions. (Because the swap contract that is the fundamental derivative instrument is normally calibrated so neither side pays anything to enter into it, which means that neither party has an *asset* as usually considered, banks typically carried their derivatives holdings off the balance sheet, and did not allocate capital against them.) The first measurement tool in looking at derivative contracts is the "Gross Replacement Value"—that is, the cost of replicating the contract in the market if the original counterparty blows up and cannot make the payments he had promised to make. This is the equivalent of an asset acquired by making a loan, and capital must be reserved against it as though it were a commercial loan.

But GRV tells nothing of market risk, and the inventors of the instruments came up with the idea of "Value at Risk," a model-based approach which like the Black-Scholes algorithm assumed a bell-shaped curve of distribution of future price movements affecting the bank's portfolio of marketable instruments and derivatives

taken together. As late as January 1999, when many less technically-minded participants had lost faith ("One survey respondent," David Clow of *Institutional Investor* reported, "complained the VAR provides merely 'the illusion of statistical certainty,' while a second simply described the system as 'useless'")²⁰, the software company Infinity still proposed in its sales literature that "The success of VAR methods over the past five years has demonstrated the feasibility of quantifying the risk of a financial portfolio *by a single number* using statistical methods."²¹ [italics added]

For capital allocation purposes, the BIS required that a bank consider as though it were a loan the higher of the previous day's calculated VAR or a number three times the average VAR in the preceding sixty business days. The bank would have to keep capital amounting to 4% of that figure on derivatives transactions with corporate customers, or 1.6% on transactions with banks in developed countries. Even at the upper range, the cost of this capital requirement was probably less than the cost of the up-front margin the commodities exchanges required for the purchase of exchange-traded derivatives, tilting the playing field toward bank-created and bank-peddled instruments.²² And two-thirds of the interest-rate and exchange-rate swaps, the dominant instruments, are between dealers—and if the dealers are banks they qualify for the lower capital weighting, which is considerably less than the cost of the margin imposed on professionals at the exchanges.²³

In 1995, BIS moved to get itself and the national banking supervisors out of the business of judging derivatives risk at banks. The new rules held that if supervisors thought a bank knew what it was doing, they would permit the bank to make its own judgment of its VAR, provided that the number could not be less than half of what the earlier BIS rules would have required. In spring 1998, just in time for the world to go to hell, the Federal Reserve eliminated the floor, and permitted the dozen giant American banks that dominate the business to write their own ticket in terms of judging the value at risk in their portfolios of marketable instruments and derivatives.

Quite a lot is wrong with this situation. For starters, it leaves the system deeply exposed to reputation risk properly defined. (The literature describes "reputation risk" as the loss to a bank's status if it handles a problem publicly and badly, but the more serious "reputation risk" as we enter the new millennium is that both decision-makers in the private sector and government regulators will trust the academic star with his second-order partial differential equations—or the fast-talker on a winning streak who wows them on CNBC—when in fact the fellow doesn't know what he's doing in the market. Ernest Patrikis when he was first vice president of the Federal Reserve Bank of New York liked to speak of "intellectual risk," that the only person in the bank who understood the position stepped off a sidewalk and got hit by a bus.) Operationally, there is the problem that the way a bank maintains a level VAR is by continuously hedging its exposure. If interest rates rise, a bank with a swap contract to pay floating rate and receive fixed rate will limit its possible future loss by selling futures contracts on Treasury notes or bonds—and if that market begins to show signs of strain he can make the computer disgorge ways to achieve the result by selling German bunds or Japanese Government Bonds (JGBs).

"The value at risk methodology," writes David Folkerts-Landau, global head of emerging markets research for Deutsche Bank and formerly head of capital markets research for the International Monetary Fund, "automatically imposes a hedging and netting vision on asset management. If, for example, an investor buys ruble paper onshore and hedges it with an offshore dollar forward contract, its net position is in dollars, so it is taking relatively low dollar risk. If the investor buys Russian shares, it can hedge by selling Brazilian shares because of the positive correlation of the two stock markets. If Russian shares are illiquid and the investor wants to close a Russia position, it can approximate the shift by shorting Brazilian shares.

"Thus, state of the art risk management methodology—endorsed by and imposed by industrial country regulators—is a primary source for the contagion effects of a crisis. . . A volatility event in one country will automatically generate an upward re-estimate of credit and market risk in a correlated country, triggering automatic margin calls and tightening of credit lines. . . Thus, apparently bizarre operations that connect otherwise disconnected securities markets are not the responses of panicked green screen traders arbitrarily driving economies from a good to a bad equilibrium. Rather, they work with relentless predictability and under the seal of approval of supervisors in the main financial centers."²⁴

Beyond that, there is the somber and generally concealed fact that the models mislead in normal times, then distort and break under pressure. A model, NYU's Stephen Figlewski writes, "is inherently simplified, representing a compromise between realism and tractability. . . However, the size of the model error and the proportion contributed by different sources are not widely known. . . In all of this is little formal recognition that these seemingly rigorous calculations actually are made by putting inaccurately estimated parameter values into incorrect theoretical models."²⁵ Some models may actually disable the functioning of markets, because they do not tell you what the prices are. Antonio E. Bernardi and Bradford Cornell report on the results of a 1995 sealed-bid once only auction of 32 different packages of mortgage securities issued originally by government-sponsored enterprises (mostly the Federal National Mortgage Association and the Federal Home Loan Mortgage Corporation), 30 of them "inverse floaters" where the income to the purchasers rose as interest rates fell and vice versa. The 20 largest dealers entered bids for one or more of these packages. One takes three such sets of bids from the report:

- a note due 5/15/99 with a floating interest rate calculated at 24.88%-(3.415xLIBOR, the London Interbank Offered Rate for short-term loans), where the high bid was 99.50 and the low bid was 79.50;
- a bond due 7/15/23 with an interest rate calculated at 36.4%-(4.137x10-yr US Treasury rate), where the high bid was 79 and the low bid was 50;
- another bond due 3/15/23 with an interest rate calculated at 52.9%-4.706xPrime, the banks' rate for loans to their best customers), where the high bid was 60.44 and the low bid was 31.

The authors point out that this sort of sealed-bid auction normally always gives a range of bids narrower than the actual range of underlying valuations, because bidders fear the "winner's curse," the public demonstration that they have paid more for something than any of their competitors was willing to pay For the 32 packages altogether, the *average* gap between high bid and low bid was 63%, and in only three of the 32 cases was the difference less than 20%.

The authors cite a "growing body of research that indicates the investors cannot be viewed as homogenous. . . 'Market knowledge' becomes increasingly important. Traders who have insight regarding which buyers are likely to place a high value on a security and which buyers will not value it so highly, can make abnormal profits in the long run, even without independent knowledge of the fundamental value of the securities."²⁶ Fancy that!

And one should note that this market is by no means the clean machine the directors of the banks (and the Governors of the Central Banks) assume it is. The BIS Committee on Payment and Settlement Systems found at most banks "discrepancies in 5 to 10% of confirmations received, but some reported percentages as high as 30% or even 50%." Where exposures are collateralized, moreover, the back office is simply incapable of matching the value of the collateral to the size of the exposure: "because of the inability of their systems (or those of their counterparties) to exchange and match information on the values of derivatives portfolios and to process the collateral movements on a daily basis, many call for collateral only weekly or monthly."²⁷

There is also a systematic bias built into the mathematical evaluation of options and option-like instruments. Because positions are supposed to be continuously hedged, the input of data, most strikingly in systems like J. P. Morgan's Riskmetrics, emphasizes the most recent transactions. The systems weight yesterday's prices more heavily than those of the day before, last week's prices much more heavily than those of the week before, until price movements that occurred on a day more than a month or two ago are virtually without weight in determining the VAR. This is especially damaging because the central assumption of all the models, that price movements are distributed along a normal curve, is simply untrue. The fancy word for recognizing this truth is "leptokurtosis," usually translated as "fat tails." The graph is drawn, showing that at the ends of the curve, more than two standard deviations from the mean, where the line of the curve should approach the horizontal axis of the graph (approaching zero probability), there remains more air—more unlikely examples—than the theory predicts. Alas, we also have "heteroskedasticity," which the graphs do not show, because the mathematicians cannot handle the fact that in real markets prices ten and twelve standard deviations from the mean are as likely as those three or four standard deviations away. When you feed in the historical data, the tails of the normal distribution curve have bumps where they should be lying down in peace. "The jump risk," notes Stephen

Figlewski, "cannot be hedged."²⁸

Running the model, then, the purely mathematical trader usually finds that volatility is overpriced—i.e., that the market price for the option reveals an "implied volatility" some tens of basis points higher than what the computer calls the "real" volatility. This is because the market, but not the model, retains some memory of a violent change in prices some months or years ago, and builds into the price an insurance premium against such events.

The mathematically inclined trader thus wants to "sell volatility"—write options that will pay off if prices don't move much—and may indeed, like Long Term Capital Management, build an entire trading strategy on the theory that the market stupidly leaves on the street a lot of nickels and dimes for computer-driven traders to sweep up. People who sell volatility make money most of the time, and if they are highly leveraged they may make a fine return on their capital for months or years, but when the world catches up with them it turns out the insurance premium they have collected believing it to be profit was wildly inadequate to the risks run. "The statistical probability" of the LTCM disaster, Michael Lewis wrote in *The New York Times*, reflecting the views of its principals, was "one in 50 million."²⁹ Volatility sellers who go broke, and their name is legion, always say that. The Chicago markets have a vulgar motto: "Traders who sell volatility eat like chickens and shit like elephants."

A fascinating large-scale example of this phenomenon is to be found in the work of Robert C. Merton, a Nobel prizewinner, one of the partners in LTCM and generally regarded as the most savvy of the financial technologists. He notes with approval the issuance by the German government of "put bonds," giving their holder the right to sell the bond back to the German government at a price somewhat below the issue price. Because the bonds are thus guaranteed against major loss from inflation, they can be priced initially with a slightly lower interest coupon (the chicken feed). But if there is an event with major inflationary consequences (the unification of Germany, the need to pay off on the guarantees given the German banks to encourage them to lend in Asia and Russia), the government could be compelled to inflate the currency or sell additional bonds at much higher interest rates in order to buy back the put bonds from their owners (the elephant do). Merton sees these bonds as "an instance of a general class of new techniques for dealing with a low-friction, global financial system."³⁰ Which raises the question of whether we need or want a low-friction, global financial system.

Why Leverage Matters

On the surface, the solipsistic mathematics behind financial engineering would not seem to matter much, one way or the other. *Chacun a son gout*. The world needs both hedgers and speculators, instinct players and technicians. Though market activity is by no means necessarily a zero-sum game, if we are going to have winners we usually need losers. The increasing share of financial intermediation in the Gross Domestic Product and the life styles of the players argues that the efficiency gains from the creation of the new instruments are not going to the society at large, but there can be no question that derivatives have made it cheaper to do many kinds of business. Even in the case of Merton's German bonds, it can be argued that the German taxpayer is better able to pay the costs of inflation (and surely is in better position to do something about it) than the German bondholder.

The derivatives literature is replete with analogies between "risk management" and insurance—and there would be even more of them if American banks were not barred by law from writing insurance—but the analogy is false. Insurance is based on the principle of risk *sharing*; derivatives are a process for risk *shifting*. As demonstrated by the failure of portfolio insurance in 1987s, when giant pension funds splurged on put options and tried to sell self-protecting S&P futures contracts to scalpers in the Chicago pits as the markets self-destructed, risk *shifting* instruments inevitably tend to shift risks onto those less able to bear them. Them as got want to keep, and hedge; them as don't got want to get, and speculate.³¹

Keynes once observed that practical men of affairs are usually slaves to the ideas of some defunct economist. In our modern world, with greater longevity and quicker communications, the economists are still alive. The fountainhead of the remoteness and artificiality of the modern financial system traces back forty years, to the

publication of "The cost of capital, corporation finance and the theory of investments," an article by Franco Modigliani and Merton H. Miller in the *American Economic Review*.³² The article starts from the significant and true observation that the real worth of an enterprise is the enterprise itself and not the paper that expresses its ownership and debt, and then moves through a series of truly heroic assumptions to the equally true but insignificant theory that if all the world has perfect knowledge of everything and there are no taxes or regulations it doesn't matter what proportion of this net worth is allocated to ownership what proportion is allocated to debt. And there are ramifications to this proposal. The managers of the enterprise should not care whether they invest in their own business or put their extra money out for loan or investment elsewhere: in a perfect world with perfect information and cost-free markets, they will know as much about other businesses as they do about their own, it will be as easy for them to invest in other businesses as in their own, and so the returns by definition will be the same. And an individual who thinks the company in which he owns stock should in fact be more highly leveraged can take care of his problem all by himself by borrowing against the value of the stock.

Watching the proliferation of theories based on what is known affectionately as "the M&M proposition," one remembers the comment of Marechal Bosquet at the charge of the light brigade: it's magnificent, but it's not war. It makes very little contact with reality. Alan N. Berger, Richard J. Herring and Giorgio P. Zego note, "The point of departure for all modern research on capital structure is the Modigliani and Miller proposition. . . [but] financial institutions. . . lack any plausible rationale in the frictionless world of M&M."³³ By extrapolation from M&M, finance economists have created a great zoo of instruments that blur long-established practical distinctions between equity and debt, long-term and short-term, dollar-denominated and ruble-denominated, safe and risky instruments. A price can always be found that fits all—when volatility is low. And the entire apparatus, of course, rests on the contrary-to-fact assumption that everybody has all the information, so that it is cost-free for lenders to monitor the financial condition of borrowers, and they do so continuously. Even Leo Melamed, chairman of the Chicago Mercantile Exchange, himself a demon trader and a great admirer of finance economists, sometimes grows weary: "Academics see the forest," he said recently, reluctantly criticizing Merton Miller. "I have to trade the trees."

A much stronger case can be made that the mixture of bank lending and markets menaces the development process because neither supplier of funds has sufficient information, and each assumes the other knows what it is doing, which permits a ratcheting of uninformed lending. The rarely admitted truth is that information plays a relatively minor role in cross-border bank lending. Diversification is assumed to improve the risk-reward ratio, and the lending officers are sent out to diversify the portfolio. Richard Dale, formerly deputy managing director of the International Monetary Fund, wrote in 1984 that "Whereas most industrial firms compete for business on the basis of relative efficiency and production costs, in international banking. . . competition is based on the lowest perception of risk as reflected in quoted spreads on international loans."³⁴ Explaining the Asian disaster of 1997, Jack Boorman, director of policy development at the IMF, told a conference sponsored by the Dutch Forum on Debt and Development that "The limited capacity of financial institutions to assess and manage risks engendered imprudent and improper decision making. . . Foreign players. . . were operating in Asia on the basis of little information, wishing not to miss out on the boom."³⁵

Unfortunately, in conditions of modern communications, cost-consciousness and moral hazard, this competition to do the business occurs in the framework of a financial system that has become very tightly articulated. All the preconditions for Minskian fragility are entrenched in the behavior of the players. The danger is not that the debtors will not be able to pay. The danger is that the creditors will not be able to do without the payments. The added loans required by diversification come out of what could have been a liquidity reserve. *It is the leverage of the creditor, not the leverage of the debtor, that creates the crisis.* In most instances—Long Term Capital Management was an aberration—lenders are more highly leveraged than borrowers. Because of that leverage, they are likely to be regarded as less creditworthy in the markets if they have to replace a missed payment: thus Citicorp, trapped in a nest of non-performing LDC loans and failed leveraged buyouts and real estate advances, was desperate to sell subordinated debentures at 14% interest in 1990.

Leverage rides on two chassis, of which the more important is still the repurchase agreement. A trader buys a bond and sells that bond to a dealer for cash, with a promise to buy it back the next day for the same cash plus

the overnight interest rate (which is lower than the accretion of interest on the bond, so he still has some earnings on the transaction). He takes that cash and buys another bond—perhaps even the same bond. And he can sell that one too with an agreement to repurchase. For the price of a million-dollar bond, he may own the income stream from \$3 million or \$4 million of bonds. The Orange County, California investment pool that went broke in 1994 had parlayed an original \$7.42 billion in resources to a portfolio with a face value of more than \$20 billion, through the use of repos.³⁶ Long Term Capital Management appears to have controlled more than \$120 billion of assets from an investment of less than \$3 billion (and continued to hold its positions after its capitalization had shrunk to less than \$500 million), mostly through the use of repos.

The dealer who lends the trader the money on a repo is protected because legally he owns the bond subject to repurchase, and if the trader fails to buy it back the lender simply keeps it and can sell it on the market to get his money back (repos are specifically exempted from the judicial stay provisions of the bankruptcy code). Thus a borrower with no great shakes of a credit record can get a low rate of interest, because of the safety in the collateral he supplies. The dealer also protects himself by giving the bond a "haircut"—paying out less than that day's market value of the bond, perhaps 1% to 3% less, to leave himself a margin of safety against declining bond prices.

Repos can also be for longer terms—a week, 30 days, 90 days—or they can be "open," to be closed out at the option of either party at any time. Even on a term repo, the interest rate is usually little if any more than the overnight rate multiplied by the number of days. The dealer only rarely holds the bond; he usually puts it out for repo himself: the big money on Wall Street in the 1980s was made in the "matched book" of repos and reverse repos in which dealers collected more interest from traders than they paid to other dealers. The contract on term or open repos does require, however, that the borrower of the money pony up additional collateral immediately if the price of the bond falls. The size of the haircut is a matter of negotiation between the parties, reflecting their relative power in the market and sometimes the scarcity of the bond being sold on repo. A dealer who is making money selling bonds to a trader may give him a reduced haircut, and if the trader is hot, the dealer may give a further discount on the haircut for the information he receives on what the trader is doing. Long Term Capital Management was able to get 100c on the dollar when it did repos.

Obviously, the smaller the haircut, the larger the inverted pyramid that can be built on any given initial stake. The higher the leverage, the more money the trader makes if interest rates go his way, and the more he loses if they don't. Sensitivity to interest rate movements is called "duration," because the prices of long-term instruments move much farther than the prices of short-term instruments when interest rates change. Repo financing significantly lengthens the duration of the portfolios of those who use it, makes them more susceptible to short-term interest rate swings (which inhibits the use of monetary policy when banks are weak), and can make them a menace to a financial system in which they play a major role.

The decision by the Federal Reserve Bank of New York to muscle a dozen of the nation's largest banks and investment banks into supporting Long Term Capital Management was publicly attributed to a concern that if LTCM did not meet its margin calls the highly leveraged banks and investment houses would have suffered great damage from declines in the value of the bonds they held on repurchase agreements. Trading in U. S. government notes and bonds, most of it to create or conclude repurchase agreements, amounts to more than \$125 trillion a year, most of it cleared with astonishing efficiency and low cost through the Government Securities Clearing Corporation.³⁷ But beneath the apparent sturdiness lurks a swampy systemic fragility.

Loans to be serviced and repaid through the cash flow of the activities supported by the loan are robust, because debt service is normally a minor fraction of the borrower's income stream; loans based on pledged assets are not, because the value of the asset can fall quickly if interest rates change. In George Soros's practitioner's language, "The value of collateral is influenced by the availability of credit."³⁸ The rating services tend to be a lagging indicator because they assess the likelihood of the repayment of a loan by the market value of the assets that can be sold to repay it, and they recognize the loss of value in those assets only after it has occurred. "Marketability," says John Heimann, "is not liquidity."

Andrew Sheng's "law of changing duration" holds that "Under conditions of uncertainty, the duration of a financial institution's liabilities shorten and the duration of assets lengthens. It is this characteristic of the loss

avoidance behavior of investors—the shortening of duration to increase liquidity—that gives rise to financial fragility, since the compression of the duration of asset portfolios leads to a liquidity crisis, causing sharp increases in interest rates which further compress asset values—a liquidity crunch becomes a solvency crisis."³⁹ The more complete the acceptance of repo financing as a tool, the lower the haircuts, the more efficient and inexpensive the processing of such transactions, the greater the likelihood of eventual crisis. And the insertion of liquidity by the central bank as lender of last resort may not be enough to stanch the bleeding, because all the participants will be clutching the liquidity to themselves rather than using it to make purchases.

Derivatives

The other chassis for overleveraging is, of course, the derivatives collection. Derivatives are not a cause of fragility, any more than guns are a cause of murder. There are many more derivatives written to lessen the risks of leveraged positions elsewhere on the books than there are risk creators. But it's easier for aggressive people to kill people if they have guns, and it's easier for aggressive traders to blow up themselves and others—including some innocent civilians far far away—when they get their hands on derivatives. After the bad experience of 1929, the American government imposed "margin requirements" to limit how much of their payment for stocks purchasers would be permitted to borrow. At present, the Federal Reserve says that buyers of stocks must put up 50% of the price. Cash out of pocket. So on the first day of spring in the last year of the century, someone who wished to buy the actual shares of the 500 stocks in the Standard & Poor index (which you can't quite do, because the index is weighted to make the stocks with the highest market value the most important in the index), would have had to put up about \$175,000.

But to buy a single futures contract on that index, controlling the same value of stock, a speculator would have needed only \$20,625, and a trader proclaiming himself a professional hedger of exposures elsewhere would have needed only \$16,500. That margin would then have to be maintained (if the price of the contract goes down, the customer must pony up more in proportion; if it goes up, he can take out cash or use his profits to increase his holdings, just as the bucket shop customer used to do in the bad old days). Or he can buy, at a price heavily influenced but not exactly controlled by the Black-Scholes formula, an at-the-money call on the index.

Alternatively, an institutional fund can control the 500 stocks in the index by entering into a "total return swap," where the other side agrees to pay at the end of the contract period any change in the price of the index, while the fund agrees to pay the other side the return on a riskless investment, plus something—these things have to be negotiated. At the moment of taking control of the stocks, however, the institutional fund need pay not one cent beyond the bank's fee. Recently there has been some movement toward making parties to total return swaps collateralize their prospective payments with deposits totaling a couple of percentage points of notional value, but this, too, is a matter of muscle.

Or an institutional trader who wants to play without putting up a lot of money can purchase an equity-linked note which pays "interest" according to movements in the S&P, and then do a repo on the note to get back nearly all the cash. . .

In short, the government declared as a matter of public policy, for pretty good reason, that the use of credit in the stock market should be limited, and the designers of derivatives have ridden roughshod over the law. It is fair to say that nobody cares (the Federal Reserve has orders to administer the law, and thinks it's silly), but if the 1997-1999 market turns out to have been a bubble someone may wish to inquire whether the abuse of derivatives was among the causes.

We set aside as premature the possibly destructive role of "credit derivatives," the fastest-growing of the new contracts, though it should probably be noted that if the banking supervisors permit banks to operate with lower capital ratios because they have off-loaded the risk of loan defaults to a derivatives counterparty, the result will be to multiply the effective leverage of the credit system. Credit derivatives have an obvious utility, permitting very inexpensive diversification as banks in the oil patch swap risks with banks in the rust belt, but the system is susceptible to all sorts of gaming, and because its attraction is that it's cheap neither side of the swap is likely to exert much diligence. "In the presence of moral hazard," two Federal Reserve Board researchers write, "the introduction of a market in credit default swaps can alter the equilibrium in the loan sales

market, causing banks to reduce their loan sales and thus increasing the likelihood of their own insolvency."⁴⁰

Where the problem has been urgent and cannot be ignored is in the foreign exchange markets. The prime minister of Malaysia has complained that speculators attacking a currency can draw firepower from derivatives contracts, while governments defending their currency must use cash. There is a certain degree of ill-grace about the author of the complaint, because the Malaysian national bank more than any other has been active in the derivatives markets and has lost some billions of dollars, but one can also argue that this experience heightened its participants' sensitivity.

The concern here concentrates on "hedge funds," large semi-private partnerships that are free to speculate in whatever markets attract them, including those their proprietors see as vulnerable to a heavy push. Relatively few of these funds are highly leveraged. The name for them was invented by Alfred Winslow Jones, whose PhD was in sociology rather than economics, and who was working as a journalist in 1949 when he got the idea that an investor could improve his risk-reward ratio if he sold the stock of the worst company in an industry while buying the stock of the best company in that industry—and that people who benefitted from such intelligent stock selection should be willing to pay the managers of their fund 20% of the profits. ("The way I like to put it," he said, "is that the investors get 80% of the rewards, and that's made them happy."⁴¹) The implication of a fund that financed some of its long positions with short positions led to leveraging, but it was not until the age of financial futures that the funds had access to instruments that compounded their resources.

What gives speculators their opportunities in the currency markets is the multiple function of money—as a unit of account, a medium of exchange, and a store of value, "a link," in Keynes's lovely phrase, "between the present and the future." The interest rate serves as an expression of this link, because it states the indifference line between having a unit of money now and that unit of money plus the interest at a stated future time. When one money is easily exchanged for another, in a cost-free market, the value of one in terms of the other at two different times should match any difference in interest rates over the intervening period; the technical phrase is "Covered Interest Parity" or CIP. Heavy sales of futures contracts in a currency will push down the apparent value of that currency looking ahead to the expiration date of the contract. To maintain CIP, then, either the current "spot" value of the currency must decline, or the interest rates in that currency must rise. And sales in a futures market, it will be remembered, can be made on quite small margin. Indeed, intensification of the attack may pay for itself as the future value of the currency falls and profits can be applied to new margin.

What is important in this process is that without an increase in interest rates for the currency under attack, the self-interest of ordinary users of the currency will lead them to acquire *now* any dollars they will need in the future, selling their own currency in the spot market for that purpose. The Korean importer will seek to pay quickly, while his won buys more dollars; the Korean exporter will wait to bring his dollars back home until they will buy more won. An engine of what used to be called "leads and lags" pulls the exchange rates in the direction the speculator wants to see. There are various ways he can cash in—through borrowing the currency now, buying dollars with it, and repaying the loan later with depreciated won, through bilateral forward contracts, through put options, through any of a number of swaps. Attacking the Hong Kong dollar, speculators sold the Hang Sen index of Hong Kong stocks, on the logic that the rising interest rates required by the effort to support the currency would depress the stock market, as indeed they did until the Hong Kong Monetary Authority decided to fight back by purchasing shares to sustain the prices.

The general belief in the economics community (and especially among bankers) is that attacks on a currency can "work" only if the nation that issues the currency has been following unsustainable policies.⁴³ In the past, CIP numbers were not good predictors of currency fluctuations. UIP—the Uncovered Interest Parity—has also not been a good predictor. The reason, Michael Mussa and Morris Goldstein of the International Monetary Fund suggested in 1993, before the blasts of contagion blew around the economic world, was that "assets denominated in different currencies are regarded as imperfect substitutes."⁴⁴ But the designers of derivatives are at the drawing boards every day, trying to make assets denominated in different currencies more easily tradable against each other. "Markets," says Jan Kregel of the United Nations Conference on Trade and Development and the University of Bologna, "are independent only as long as they're national. If everybody invests across all markets, you lose the diversification you thought you had."

Barry Eichengreen argues that "changes in technology, policy, and market structure have created an enormous pool of liquid funds ready to move at the first hint of devaluation risk. Foreign asset positions are actively managed by institutional investors. . . Fund managers in the business of monitoring current developments are able to alter the composition of their portfolios at low cost. Improvements in trading and information systems and back-office clearing and settlement systems have increased the speed and reduced the cost at which transactions can be undertaken. . . The extent of the resources that the markets can bring to bear makes it difficult to hold out in the face of speculative pressures." Under these circumstances, even countries with entirely defensible domestic fiscal and monetary policies can find themselves under the gun. An attack on the currency forces an increase in interest rates if exchange rates are to be held steady. The increased interest rates may be intolerable because they depress domestic production or bust the banks or create large government deficits as debt rolls over. Eventually, the government decides to let the exchange rate rather than the domestic interest rate take the heat. A nation as important as France, with all the help France could summon in an emergency, was unable to maintain the exchange value of its currency in the face of attack in 1993, though the currency was not in fact overvalued, French policies were in fact sound, and values returned to just about their previous level in a matter of months after the attack ended. Eichengreen comes to the conclusion that in the 21st century both pegged exchange rates and "target zones" are impossible: the choice is between monetary integration—the European Monetary Union or Argentine-style dollarization—and freely floating currencies.⁴⁵

But if a local enterprise has debts denominated in foreign currencies, which is clearly the way the financial markets want to work, allowing the currency to float may bankrupt local industry. Indonesia supplies the existence theorem, if one is needed.

An Awkward Fact

A man who runs a hedge fund said impatiently about half an hour into an interview, "You sound like 1952."

What does that mean?

"You keep talking about *banks* . I don't do business with *banks* . I have a better credit rating than *banks* . I do business with Bear and Goldman and Morgan Stanley and Merrill. If I need cash, I take a triple-B bond and I repo it with Merrill in London through Euroclear."

The Securities and Exchange Commission has supervisory authority over broker/dealer firms, but not over their holding companies, and it has never attempted to extend its reach beyond the United States. Merrill Lynch in London (indeed, in Europe, because the rules of the European union require a "consolidated supervisor") is a ward of Britain's Financial Services Authority, which is new at this game and doesn't care much about repos, and has no *formal* way to examine what Merrill is doing in the United States. When Merrill does derivative transactions through its separately capitalized AAA derivatives subsidiary, nobody supervises it at all. By law, derivatives are not securities, so the SEC is not involved; and the Commodity Futures Trading Commission has given over-the-counter financial derivatives a blanket exemption from regulation.

The Federal Reserve System used to examine the activities of primary dealers in U. S. Treasury securities, but after the Salomon Brothers scandal of 1991 revealed the inadequacy of the supervision the Fed retreated to a more generalized concern about "the market," so that nobody in authority knows any bank's or broker/dealer's repo positions. Repos have always (correctly) been considered secured extensions of credit with carve-outs from the bankruptcy code, and until early 1998 the Federal Reserve imposed margin requirements on everything except Treasury paper, limiting if not avoiding the dangers of pyramid-building. Those requirements were dropped, and banks and dealers were given the go-ahead to extend credit on the pledge or promised repurchase of debt securities on "good faith" rather than market valuations.

In the derivatives area, instruments are created off the balance sheet by private contract between consenting adults, and nobody knows—for example—how many non-deliverable forwards were written on the Russian ruble, or their total value, before the lights went out on August 17, 1998. Where a currency is used in trade, importers and exporters work with forward contracts which allow them to lock in today the value of what they

will pay or receive for the goods they have bought or sold for future delivery. Where there is no forward market in a currency, investors or traders can hedge their exposure to an investment or a transaction that worries them by placing a bet on what the currency will be worth on some specified future date. A "non-deliverable forward" on a ruble typically set a price below that day's price of the ruble. If the price of the ruble remained above that forward price, the party trying to protect the dollar value of his rubles would owe money to the ruble side; if the price of the ruble fell below that asserted forward price, the believer in the ruble would owe dollars to his counterparty. Presumably, the owner of the dollar side of that contract could then safely change his money into rubles and buy those lusciously priced Russian government notes or make a high-interest deposit in the counterparty bank, knowing that he had hedged against the danger of a decline in the ruble. Estimates of the quantity of nondeliverable forwards written on the ruble start at \$6 billion and often run much higher.

One notes that in the end the real value of these contracts depended entirely on the counterparty. Where they were written by a weak Russian bank, they turned out to be worthless: the bank disappeared. Where they were written by a big international bank, they might be paid off or they might be repudiated—some well-known banks did that—on the grounds that Russia's default on its domestic debt was an Act of God that relieved banks of merely contractual obligations. Where they were written by a Russian government bank (especially Sberbank, the national savings bank, which has assets outside Russia that could be seized), negotiation was possible, and claimants got as much as 47c on the dollar. The lack of good information about whether, when and what one would be paid on these instruments was among the causes of the uncertainty that locked up the financial markets in September and early October.

Another source of uncertainty was the discovery by the chiefs of the big banks and broker/dealers in fall 1998 that their own management information systems did not provide accurate information on their exposure to counterparties, or to certain derivative instruments or to both. Traders with nondeliverable forwards in their portfolios, for example, had reported no exposure to rubles. One of the lessons to be learned from fall 1998, John Heimann told the Merrill Lynch executive committee, is that "What is off-balance sheet is as important as what is on-balance sheet." Another is that "In times of turmoil, market participants cannot rely upon netting." One should note that the netting problem is further complicated by cross-default clauses—but also, as an unhappy supervisor insists, that even a limited netting process is probably better than no netting process at all.

Alfred Steinherr—who believes in derivatives, who has suggested that some day workers in cyclical industries will be able to buy derivatives that will hedge them against the risk of being laid off—wrote just *before* the turmoil of 1998: "The lack of transparency of the financial activities and risk positions of financial intermediaries has added to the risk of major financial crises. . . . During episodes of market stress a lack of information about a firm's market and credit risk exposures, and a lack of confidence in its risk-management abilities can create an environment in which rumors alone can cause a firm's creditors to lower their exposures, thus impairing access to funding at the very time when it is needed most. . . . Derivatives make it cheaper and faster for market participants to 'run' from suspected institutions, making the system more fragile, and putting a premium on financial disclosure."⁴⁶

Finally, episodes of official misstatement not only to the public but to national and international authorities have poisoned the wells. The Bank of Thailand committed its foreign exchange reserves to forward contracts but continued to claim the money on its books; the central bank of South Korea placed much of its reserves with its own national commercial banks, supposedly to get better returns but really to make these banks look more sound than they were, and continued to claim the money on its books. When these countries turned up as claimants from the International Monetary Fund, then, their condition was desperate; the world still saw them as real tigers, but they weren't even paper tigers any more.

Que faire?

Tolstoy's question haunts: What is to be done?

The search for an answer is made more difficult by the fact that nobody dares speak a word against "transparency": better information is the first requirement. But as the old spiritual has it, all them talkin' 'bout heaven aint goin' there. Neither bankers nor central bankers believe in transparency; they believe in bank

secrecy and will fight pretty close to the death to preserve it. The tip-off is the attitude toward OTC derivatives, totally hidden, a source of desperate confusion under pressure, capable of demolishing the prices on the public markets when released—defended aggressively by bank supervisors even though exchange-traded derivatives, publicly traded and priced with open interest reported in the paper every day, are in the overwhelming majority of instances effective if not perfect substitutes. Central bankers believe that nothing stands between the markets and chaos, nationally and internationally, except their exclusive power to value bank assets behind closed doors and assure the outside world that all is well. In 1989, at the depth of the American real estate crisis, the regulators hastily issued new rules permitting banks to value their real estate loans and foreclosed holdings for what they hoped this stuff would be worth in five years, without regard for what it might be worth today. At a Senate hearing, Federal Reserve Chairman Alan Greenspan, Comptroller Robert Clarke and FDIC Chairman E. William Seidman answered a question from Banking Committee Chairman Donald Riegle. Were the real estate loans in the banks, Riegle asked, better or worse than they had been a year before? And all three said, "Better."

Depositors and most other lenders to banks can take their money back at will, and a bank can lose its funding very quickly. To the extent that banks are the source of finance for speculative positions in the market or for enterprise in other countries, knowledge of the involvement can be dangerous to their health. At the first sign of trouble in the portfolio, there can be a run on the bank. In many countries, good information about the condition of the banking system would be disastrous. Human kind, the bird said to T.S. Eliot, cannot stand very much reality; a high fraction of the world's banks cannot stand any.

If economic development is to be financed to a major extent by banks, if banks are to be major players in OTC derivatives games, there cannot and will not be much "transparency." Transparency compels the recognition of credit risk, and "credit risk," says John Heimann, "is like cancer." Depositors in and lenders to a bank will not believe that work-out processes will cure publicized defaults. Restructuring a bank loan is at best a trauma for all concerned, and some years are necessary before the wound heals—and in the meantime, one notes, taxpayers must be plucked for the comforter that keeps the banks warm. Those are the results of transparency imposed upon the existing system. Market risk, by contrast, Heimann says, "is like a high fever: it goes away quickly." The size of the loss is known and accepted, and either the patient survives or he doesn't. Calling for transparency is calling for a market-dominated system, in which losers recognize their losses. Markets impose on those who wish to get out fast penalties sufficient to keep most of them in—and if the emigrants decide to pay the penalties and flee, markets automatically find price levels at which, perhaps with a lapse of time, new buyers can be attracted.

The first lesson of the Asian crisis for American commentators and the academics who follow American leads is that *the world financial system is in a transition period from banks to capital markets*, and that outside the United States the banks still matter enormously. In the United States, only about 20% of commercial lending is funded on a banking chassis; in "emerging markets" the proportion is likely to be 80%. It is not only in Asia that families of enterprise cluster around a papa bank. In Germany, France, Spain, Belgium these "relationships" are still crucial. In such frameworks, the best information is at the banks, which keep it for themselves.

But over time the markets, because they are more efficient in their pricing, more inclusive and less credit-dependent in their funding, will take over in other countries as they have in the United States many of the functions previously exercised by banks. Markets are omnivorous consumers of information of all kinds, but in response they provide only a price, and the price changes. As Leibnitz suggested in a slightly different context three hundred years ago, at any given moment all available information must be in the price, so if the price changes, the information must have changed. As financial intermediation moves from banks to markets, transparency is needed to avoid surprise; markets do not handle surprise well. The market pool of information is very wide and very shallow; possible substitution must be easy, and by devaluing knowledge, the sole source of real confidence, diversification will paradoxically reduce the participants' sense of security even as it lowers the likelihood of serious loss. Sampling the shallow pool of market information is inexpensive and thus frequent; mining the deep shafts of banking information is costly and thus rare. Indeed, through the process of securitization and the marginalization of lending officers, banks are losing their expertise in the condition of borrowers. And today of course—it was not true seventy years ago, when the prime rate was *the* number and stock in most banks was traded over-the-counter for unreported prices, as derivatives are traded now—the markets set interest rates, and price the equity, assets and debts of the banks themselves. The collapse of the

prices for shares in financial services companies—which accounted for more than 60% of the value of shares on the Tokyo Stock Exchange at the peak in 1989—led to the "Japan premium" Japanese banks had to pay for funds, and to the fall of commercial and industrial lending that pressed down the real Japanese economy.

Banking supervisors through their manipulation of information and central banks through their lender of last resort functions can create a breathing space. (Some hedge funds survived the panic of fall 1998 only because their founding documents forbid their investors to take money out except at stated intervals.) But the banking authorities will normally use their breathing space to maintain what may or may not be a fiction that the problem is liquidity rather than solvency. If only because the liabilities of the banking system are the currency of the country, central banks will not, cannot, allocate losses until the last moment. *In the transition from bank-dominated to market-dominated finance, when the ponderous pace of information change in the banking nexus meets the quicksilver movements of the markets, systems for standstill will have to be developed.* Because the markets cannot stand still, and because they are the long-term victors anyway, the control must be on the banking side. Broker/dealer firms that do a considerable merchant banking business—Bear, Goldman, Morgan Stanley, Merrill, Salomon Smith Barney in or out of Citigroup—should also be held accountable on a consolidated basis, including activity in the holding company and abroad, for the maintenance of capital adequate to absorb the inevitable shocks.

Some palliatives commend themselves:

- The terms for cross-border lending to borrowers in currencies other than the domestic currency of the borrower could be written to require the lender to accept a 60-day or 90-day rollover of the loan under specified conditions.
- H. Johannes Witteveen, who was managing director of the International Monetary Fund from 1973 to 1978 when the Fund was in the Valley of Death, has suggested that central banks join together to establish reserve requirements to limit the creation of off-shore deposits, which have become "an uncontrolled source of international liquidity."⁴⁷ This has become a particularly serious problem as the U. S. government domestic budget has moved into surplus, diminishing the supply of government bonds, which (at the strong insistence of Arthur Burns in the 1970s) were the medium by which dollars exported to pay U.S. current account deficits were returned to the control of the Federal Reserve. In the 1990s, American trade deficits have been financed by an autonomous inflow of private investment capital, often most easily arranged and serviced with off-shore dollar financing, facilitating the creation of dollar liquidity by banks outside the United States.
- Laws could be written to require minimum haircuts on repos, with exemptions for repo-financed government bond dealers. The Working Group of the Basle Committee on Banking Supervision recommended that the Basle Accord on capital weightings be re-examined to do something about "the absence of capital charges for possible unsecured exposures resulting from repo transactions. . . . maximum collateral valuation rules could be established which would reflect the price volatility of underlying securities. . . . It would, inter alia, imply the acceptance of OECD government securities against somewhat less than 100% of market value."⁴⁸ It should be noted that haircuts given to repo'd paper do not affect the financial reports of either borrower or lender. If the transaction is regarded as a loan, which is the norm and has the approval of banking supervisors, the borrower continues to count the security as his asset at market value; if it is regarded as a true purchase with a contract to sell back, both sides carry the transaction at the fluctuating value of the contract.

George Martin has ingeniously proposed that repo customers of banks should also be swap customers, to increase the transparency of the borrower. "In essence," he writes, "this is nothing more than hedging exposure to rate movements with the lender, so that the lender can observe your hedge. This works in interest rate markets. . . . when one wants exposure to the credit/liquidity spread but not to the base rate risk."

- Alfred Steinherr has suggested that regulators set capital requirement for derivatives trades at a number that at least matches the margin requirements of the exchanges on which similar derivatives are traded. At this minimum, a significant number of banks might find the lower risk of the exchange-traded instrument sufficient inducement to move to the more transparent market. Because the exchanges set margins at a number where a one-day move will almost never take it all, the current capital requirement for OTC derivatives would be more than doubled.

- A requirement of continuously maintained margins on every contract (collateral for OTC instruments) would give early warning of the malfunctioning of a hedge. A generalized clearing house for standardized OTC derivative contracts, which is in the works for swaps in London, could impose gross rather than net margin requirements on traders without diminishing the benefits of well-thought hedges (because truly coordinated hedges would permit the trader to pay the maintenance margin demands on one contract with the excess margin on another; to the extent that a traded derivative hedges an asset, Financial Accounting Standard #133 should permit offset within the bank).
- The central bank of Portugal now publishes the total borrowings from Portuguese banks by very large borrowers, specifying the borrowers but not the banks. More than half the members of the International Monetary Fund now consent to the publication of a Press Information Notice describing the Fund's findings in its annual review of their condition and prospects. The SEC requires all insiders to report their purchases and sales of their company's stock, and includes in the definition of "insider" any investor who owns more than 5% of the corporation. The clearing houses of the commodities exchanges compile (but do not publish) large trader positions. In general, the bias should be toward the revelation of all large positions in all markets. One of the reasons the Long Term Capital Management fiasco created such a disturbance was that the lenders to this operation did not know how large LTCM's position had become and how many other large lenders the fund had swept in. (A supervisor on the margins of this fiasco argues that if the lenders were ignorant it was their own negligence, because the year-end statement of LTCM given to its lenders and investors, while not very informative about assets, had covered an enormous waterfront of liabilities.) The Basle Committee's Working Group has suggested "a general review of the adequacy of public disclosure by financial market participants." The borrowings of very large borrowers and the holdings of very large traders should certainly be a matter of regulatory knowledge, and perhaps of public knowledge. Since all these people use computers all the time, that information could be communicated daily.

All these are either a heads-up to the market or a guarantee of delay in the explicit but not implicit recognition of losses. Like the "Tobin tax" on financial transactions, they are ways to scatter some sand in the wheels. As such, they would no doubt increase the cost of cross-border credit, but the imposition of such costs by the polity is clearly justified to compensate the world at large for the increase in risks imposed by proliferating innovation in financial markets.

A potentially very significant brake on the accelerating damage now done to countries suffering a currency crisis would be the creation of an international trade-finance institution to maintain the pace of export credits for countries that have lost access to such credits because the top management of banks far away has demanded a reduction in their "exposure" to a country in trouble.

Several principles must be accepted from the start.

The first is that *markets do not create the legal order; the legal order enables the markets*. Ideally, they grow together, in tension but responding to each other's needs. Freedom of contract may be a God-given right, but the enforcement of the contract is a matter of state. Thus there need be no serious worry about losing the business to the Cayman Islands or Guernsey or Andorra. If the rules are written so that the courts of the great nations will not enforce certain contracts entered into in jurisdictions with inadequate regulations, the participants in the markets will live by the laws of the great nations. The felt need of the participants is for "legal certainty." A price can be charged for that.

Second, *the authorities will always have much less secure a grip on borrowers than they have on lenders*. If the borrower can get the money at the price his euphoria or desperation tells him he can afford, he will take the loan, and will not be terribly picky about the details. The grip on the lender is capital requirements, imposed risk weightings, and (with asset-backed lending, including repos) margin requirements. To make such requirements effective, of course, there will have to be international agreements like those already agreed upon in Basel, retaining some wiggle room for national authorities. And there will have to be international standards of accounting and banking supervision. This is no reason for despair: both these ventures are well off the starting marks and advancing.

Third, apart from the assertion of the principles of fair dealing (including generalized access to information),

the purpose of rules should be to enforce the recognition of realities. Value-at-Risk having failed as a measurement, the fashion in bank supervision now is the stress test. Banks run these tests themselves through their own models. The function of banking supervision should be to supply plausible parameters for testing, to retain records of the results, and to insist that these results be communicated directly—probably in the presence of the senior examiner—to the board of directors of the institution. The public policy question is whether the adoption or continuation of practices indicated as high-risk should be left entirely to the board or whether the regulators should automatically impose additional capital requirements on banks—and, incidentally, on investment banks, which in the United States, by law, have to meet capital standards. In general, within broad limits, the bias should be to permit these very large institutions—for it is only the large institutions that threaten to destabilize the system—to conduct their business as they see fit, once the risks have been registered with the supervisors (which presumably prepares them for possible future trouble) and accepted by a fully informed board of directors.

Finally, *though the governments of the developed countries acting together do have the "power" to control market behavior, it is doubtful that they have or will have the competence to do so.* To use John Heimann's analogy, there is not much point setting bloodhounds to track greyhounds. *The governments cannot design a new architecture, but given the certainty that the private sector's risk-control models will fail at some point, they can demand earthquake bracing.*

"Successful public policy," Robert Merton and Zvi Brodie write, "depends importantly on recognizing the limits of what government can do to improve efficiency."⁴⁹ But at this time in this place, *efficiency cannot be a primary goal for government intervention.* The first consideration, as existing laws recognize, must be safety and soundness, and *where the more efficient is less safe, an acknowledged trade-off must be accomplished.*

The late Richard Hamming, inventor of the checking code that makes the computer reliable and chief mathematician for the Manhattan Project during the war, liked to tell the story of J. Robert Oppenheimer's visit to his office at Los Alamos in summer 1945 to invite him to come to White Sands and see the detonation of the world's first atom bomb. Hamming declined, and Oppenheimer said, "I don't understand that, Dick. You have three years of your life in this project. Don't you want to see it happen?"

And Hamming said he replied, "No. If I got the math wrong, none of you is coming back, and there ought to be at least one of us who remembers what we did."

That spirit should guide the conduct of government regulation of financial services in the early years of the new millenium. Market activity, like other forms of economic activity, is a form of human behavior, which can be assumed away in financial engineering but not in real life. All countries have signed off on Article IV of the Articles of Agreement of the International Monetary Fund, requiring that "each member shall: (1) endeavor to direct its economic and financial policies toward the objective of fostering orderly economic growth with reasonable price stability. . . [and] (2) seek to promote stability by fostering orderly underlying economic and financial conditions and a monetary system that does not tend to produce erratic disruptions." These, not the facilitation of trading opportunities or capital movements *per se* , are the relevant objectives. It's the economy, stupid, not the market for paper. *Regulation is a political activity that should be informed but not commanded by the abstractions of economic theory.*

This Brief has benefitted greatly from extensive comments and criticisms by John G. Heimann, George Martin, James T. Moser, Patrick Parkinson and Eugene H. Rotberg. The errors remain my own—Martin Mayer

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