

Apocalypse Roulette: The Fall of Long-Term Capital Management

By Alex Burns (alex@disinfo.com). Australian Foresight Institute/Disinformation®, November 2002

Abstract

This essay explores the notorious rise-and-fall of the Long-Term Capital Management hedge fund. The author contrasts three populist analyses—the documentary *The Midas Touch* (1999), Nicholas Dunbar's *Inventing Money* (2000) and Roger Lowenstein's *When Genius Failed* (2001)—with Bank of International Settlements, Federal Reserve and other documentation. The role of the Black-Scholes equation and John Meriwether's strategies for arbitrage trading as intellectual capital is considered. LTCM's use of financial mathematics and forecasting is examined in the context of Ulrich Beck's 'world risk society'. Finally why LTCM challenged the global financial system and subsequent policy initiatives are outlined.

Financial Alchemy

The dramatic rise-and-fall of Long-Term Capital Management between February 1994 and October 1998 almost triggered the collapse of the international risk management system. LTCM was the financial equivalent of a secret society, for although it was spearheaded by impresario trader John Meriwether, employed Nobel laureates Roger Black and Robert Miller, and speculated on behalf of risk-averse international banks, the hedge fund's derivatives niche was esoteric, and its quantitative risk models were frequently compared to Renaissance-era alchemy.

LTCM's models and strategies were the outcome of a decades-long search by academics and traders to eliminate risk altogether from stock market speculation. The documentary *The Midas Formula* (1999) contended LTCM was the real-world laboratory for 'the equivalent in economics of the race to the moon' (Clark, 1999). Two detailed popular accounts (Dunbar, 2000; Lowenstein, 2001) depicted a tight-knit cabal that tore itself apart during acrimonious crisis management. LTCM also became notorious in the financial press (Lowenstein, 2001, 162). Journalists contrasted the elusive Meriwether with the philosophical George Soros, debated securities regulations and asked why the Federal Reserve, the U.S. government's oversight institution for financial markets, facilitated a \$3.65 billion bailout of LTCM's partnership by fourteen banks (Lowenstein, 2001, 218)

Yet the press coverage also reached misleading and sometimes superficial conclusions (Temple, 2001, 89). *The Midas Formula* contended LTCM's failure was because its traders were wiped out by a freak event: when Russia declared a 'debt moratorium' on 17 August 1998 (Lowenstein, 2001, 144; Dunbar, 2000, 200). The press likened this 'freak event' to *The Perfect Storm* (2000) (Dunbar, 2000, xiii). They focused on Myron Scholes and Robert Merton, two PhD academics who had been awarded the Nobel Memorial Prize in Economic Science during October 1997 (Lowenstein, 2000, 116), however both had been outmaneuvered in LTCM by Meriwether's trading team. The reasons went beyond the false dichotomy of academic blind-spots and trader hubris. LTCM's collapse revealed why the 'world risk society' of international finance 'balances its way along *beyond the limits of insurability*' (Beck, 1999, 32).

The Black Arts of Risk Arbitrage

The 'Black-Scholes' equation (named after Scholes' late colleague Fischer Black) and Merton's work on 'continuous time' forever changed how economists viewed risk. In the 1950s economists rediscovered Louis Bachelier's *Theory of Speculation* (1900), a grimoire that was the 'first mathematical model of the markets' (Clark, 1999). Risk management models like Harry Markowitz's 'portfolio theory' and William Sharpe's 'capital asset pricing model' enjoyed popularity in corporate circles as risk management increasingly defined a company's 'strategic exposure', 'financial decisions' and 'global competitiveness' (Joseph, 1999, 75; Fontela, 1998, 752). One of the most prominent was Franco Modigliani and Miller Merton's 'irrelevance position', taught in American MBA programs, a paradigm which contended that 'unsystematic risks are diversifiable and only systematic risk matters' (Joseph, 1999, 76; Vukson, 2002, 82). These models enabled strategists to manage risk by altering their portfolio's make-up.

'Black-Scholes' was an 'elegant' formula [$C=SN(d_1)-Lt^{-r}N(d_1\sigma\sqrt{T})$], a form of 'financial engineering' which promised the impossible: 'risk can be conjured away' altogether (Dunbar, 2000, 68, 2, 36). The formula dispensed with complex psychological factors and reduced its variables to the initial stock price, the strike/exercise price, its volatility, the maturity (lifetime) of contract, the risk-free interest rate and the level of risk (Dunbar, 2000, 40). 'All were quantifiable, except for the last, risk' (Clark, 1999). The key assumption of the 'Black-Scholes' equation was the Efficient Market Hypothesis which 'holds that markets always react rationally to developments' (Dreman, 1998, 283; Dunbar, 2000, 43). This also meant that 'the volatility of a security is constant' (Lowenstein, 2001, 68). By factoring the standard deviation of price (volatility) the equation provided traders 'a way to calculate the value of any option they liked' (Dunbar, 2000, 73). As FIMAT Brokers' Stan Jonas explained, 'If I know the price of the stock, I know the price of the option' (Clark, 1999; Lowenstein, 2001, 124).

The equation's philosophical roots also included heat distribution equations from physics (Lowenstein, 2001, 69) and 'normal distribution' patterns of statistics (Lowenstein, 2001, 65), the latter more widely known as 'the random walk hypothesis' (Dunbar, 2000, 92). Soon the 'Black-Scholes' equation had migrated from academic journals to trader's calculators, a replication of how other tools had been legitimated. Strategic planning had been energized by a wave of vertical integrations. The early 1970s oil embargo had validated Pierre Wack's scenarios at Shell. Now 'Black-Scholes' revolutionized financial modeling.

Merton's pivotal insight made 'Black-Scholes' operational. Influenced by the complex Ito calculus used to calculate a rocket's position and velocity, Merton created 'continuous time finance' (Lowenstein, 2001, 29) which 'divided time into infinitely small parcels, smoothing it out so that it became a continuum, so that it could be constantly updated' (Clark, 1999). Merton, who also subscribed to the Efficient Market Hypothesis assumed that markets were 'frictionless' (brokers' transaction fees, had liquidity (people could buy and sell freely) and were 'continuous' (traders could process 'infinitely often') (Dunbar, 2000, 90). These initiatives laid the groundwork for contemporary futures trading and option pricing. Advances in computer technology (Lowenstein, 2001, 8) enabled traders to model 'continuous time finance' as market positions unfolded.

For Stan Jonas, these insights provided 'a mathematical argument for trading a lot . . . the more we trade, the better off the society is, because the less risk there is . . . in order to reduce risk, we have to trade everywhere and all the time' (Clark, 1999). This belief coincided with the eclipse of Keynesian intervention by Chicago's 'supply-side' school. It resonated in a sociopolitical climate that had been buffeted by the collapse of the Bretton Woods system, the oil embargo by the Organization of Petroleum Exporting Countries, the 'Vietnam Syndrome' and U.S. domestic stagflation (Lowenstein, 2001, 7; Dunbar, 2000, 56). This history and symbolism enabled the 'social construction' of international risk management (Beck, 1999, 143). A new generation of traders, armed with 'Black-Scholes' and new variants, was ready.

The Arbitrage Group: Foresight or Pure Luck?

In 1977 the young trader John Meriwether formed the Arbitrage Group, a specialized bond arbitrage desk, in Salomon Brothers (Lowenstein, 2001, 9; Dunbar, 2000, 64). Its members were sworn to secrecy (Lowenstein, 2001, 17), a decision that would have devastating consequences for LTCM. Arbitrage strategies enabled traders ‘to profit from small price anomalies between similar stocks in different markets’ (Temple, 2001, 23). Meriwether had joined Salomon in 1974 and began trading Treasury bonds in 1977. His moment came suddenly on 6 September 1979 when the U.S. government changed its monetary policy from Keynesian to Robert Lucas’ ‘rational expectations’ model. Nicholas Dunbar observed: ‘We will never know how much of what followed was due to foresight or pure luck’ (Dunbar, 2000, 65-66).

Meriwether’s legendary tactics at Salomon were captured in Michael Lewis’ book *Liar’s Poker* (Lewis, 1989) and he became partner in 1980. But Meriwether faced problems despite leading one of the finance industry’s most lucrative divisions. ‘Black Monday’ on 19 October 1987 was triggered when a ‘Black-Scholes’ variation combined ‘portfolio insurance and index arbitrage’ strategies and created a ‘doomsday machine’ that wiped billions off the markets’ value (Dreman, 1998, 283). Computer models were blamed but analysts should also have realized that ‘Black-Scholes’ provided no coverage for freak and uncertain events (Lowenstein, 2001, 72). Some did: Nobel laureate and economist Paul Samuelson wondered ‘if the models were ready’ (Lowenstein, 2001, 70). When Salomon’s other traders discovered that Meriwether had cut a salary deal for his arbitrageurs they were furious. In retaliation trader Paul Mozer ‘submitted a false bid to the U.S. Treasury’ for a bond auction (Lowenstein, 2001, 19-20; Temple, 2001, 95). Mozer told Meriwether, who, in loyalty to his arbitrageurs, tried to downplay the scandal. Meriwether was forced out of Salomon in the ensuing purge.

To appreciate how Meriwether regenerated his career it is crucial to understand how he reframed the ‘academic-trader’ divide as an ‘intellectual capital’ resource. *The Midas Touch* presented this divide as a caste-like system which reinforced ‘Ivory Tower’ versus ‘Machiavellian Pragmatism’ stereotypes. Academics and traders were at war with each-other. For traders ‘Black-Scholes’ was a fluke that ‘would complement their intuition’ (Clark, 1999). The reality was far more complex and highlighted the changing nature of ‘knowledge production’ in post-industrial economies.

While many Wall Street traders shunned academia, Meriwether foresaw that their quantitative and research skills ‘would be his edge’ (Lowenstein, 2001, 11). He staffed Salomon’s Arbitrage Group, and its successor LTCM, with the same ‘core’ people. Many were ‘PPE’ types—a psychographic label given to analysts from Ivy League universities and England’s Oxbridge—who possessed ‘a background in politics, philosophy and economics . . . the right combination of market insight and cultural knowledge . . .’ for the new geopolitical environment (Dunbar, 2000, 77). Their models, and developing superior ones to competitors, was crucial to an institution’s sustainable long-term growth (Lowenstein, 2000, 65). Hence there was a spiral between ‘banks and universities where innovation happened’ to ‘markets where new products were ‘commoditised’ (Dunbar, 2000, 113). But Ivy League exclusivity

soon bred arrogance that affected the partnership's decision-making (Lowenstein, 2001, 89).

In 1993 Meriwether approached Merton and Scholes to join LTCM, a new hedge fund, based in Greenwich, Connecticut. Many of Meriwether's team at Salomon had already defected. Later Scholes stated he had joined as 'a way to see the application, to practice' (Clark, 1999). Their initial success meant Merton and Scholes proved 'academics could cut it in the real world' (Clark, 1999). Scholes' charismatic performance on a joint LTCM/Merrill Lynch roadshow meant that university funds and institutional investors had 'invested \$1.5 billion by early 1993' (Dunbar, 2000, 130). Consequently LTCM began trading on 24 February 1994 'with \$1,011,060,243 of investor capital' (Dunbar, 2000, 142).

Press coverage of Scholes and Merton's role in LTCM also obscured the reality that such hedge funds had a 'white-collar/blue-collar' divide between 'strategists; traders, risk managers, software designers' and the 'pit trader and back office employees' (Dunbar, 2000, 127-129). LTCM's key partners were able to invest their life savings in the company's portfolio, unlike their 'blue-collar' support staff. As the company's portfolio grew its management 'became bewitched by their own success' (Dunbar, 2000, 169). An early sign of this was LTCM's success in gaining investment commitments from international banks that did not invest in other hedge funds (Lowenstein, 2001, 37-38), which made it more difficult for partners to question their 'mental models' as later crises unfolded. During the crisis this divide triggered a 'mini-revolt' between the partnership and its other employees (Lowenstein, 2001, 225).

An 'Insurer of Financial Risk'

In the early 1990s, after the Savings & Loan crisis of the Reagan Administration, the caps market and option pricing became popular with financial analysts (Dunbar, 2000, 107). Hedge funds dealt with the full spectrum of new speculative tools including derivatives, futures markets, currency swaps and options. These tools enabled risk-averse investors to transfer their risk to 'those who were prepared to take risks to earn a profit' (Dunbar, 2000, 134). Each tool 'was buffeted by different risks' and this new hazard was soon labeled 'market risk' (Dunbar, 2000, 136). George Soros' Quantum Fund personified this image. As 'market populism' and day trading subculture influenced the mid-1990s bull market, however, Soros was replaced by Omaha investor Warren Buffet as a role-model (Frank, 2002, 111).

LTCM existed in another world altogether. Hedge funds were highly secretive: they were not subject to Securities & Exchange Commission regulation but some reported to the Commodities Futures Trading Commission (Lowenstein, 2001, 24). The partnership dealt with 'off balance sheet' items like 'cross-currency swaps' between American and European firms (Dunbar, 2000, 75). LTCM essentially viewed itself as an 'insurer of financial risk'. What Meriwether's team at Salomon's Arbitrage Group did, and what LTCM continued, was speculating on long-dated index options that the team believed were overpriced. This put LTCM in opposition to risk-averse banks and mutual funds for LTCM dealt in 'risk that others didn't want' (Dunbar, 2000, 174).

LTCM's Trading Strategies

The financial alchemy was because Meriwether's team understood that 'trading the underlying stock' enabled options to be replicated (Dunbar, 2000, 88). LTCM didn't own its investments, nor did any LTCM money in 'collateralised loans' necessarily change hands (Lowenstein, 2001, 45, 103; Dunbar, 2000, 192). Instead LTCM's traders were 'making side bets on the *direction* of stocks' and by guessing the market's '*inferred* volatility', or what other investors were paying (Lowenstein, 2001, 126). Their assumption of 'continuous' markets led LTCM's traders to believe that efficient markets would become less volatile over time (Lowenstein, 2001, 76). LTCM's *modus operandi* was that its swaps were a symmetrical 'two-way mark-to-market collateral agreement' (Dunbar, 2000, 149) which could be monitored by computers. 'Marking-to-market' meant that trades were valued 'at the current market price rather than its book cost' (Temple, 2001, 161).

What made LTCM different to other arbitrage firms was its approach to leverage: it borrowed \$100 billion for investments with only \$3 billion in reserves (Clark, 1999). Hedge funds needed leverage because they had to invest 'huge amounts of money to make a very small profit' (Berton, 2001, 10). They could do this because, not being subject to SEC reporting, hedge funds avoided the '50 percent margin rule' which regulated traditional banking institutions. LTCM's high-profile management was notably exempted ('the halo effect') from margin rules and other market regulations (Temple, 2001, 172). Leveraging enabled hedge funds to rearrange their trading portfolios 'with a larger expected return' (Dunbar, 2000, 140). This diversified risk strategy had a dark side: if many different institutions owned the same financial securities a crisis could trigger a contagion-like scare (Lowenstein, 2001, 42). LTCM's trades after Russia's loans default occurred because its management 'had done essentially similar trades in similar instruments' and global linkages meant 'they all went bad at the same time' (Temple, 2001, 173).

Although LTCM's strategic godfathers were Scholes and Merton its Italian trades engineered by Victor Haghani offered a more relevant case study of the hedge fund's tactics. LTCM primarily invested in bonds (corporate, government and emerging markets) and mortgaged securities (Temple, 2001, 98). LTCM's market-neutral or 'relative value' trading style 'bet on spreads between *pairs* of bonds to either widen or contract' (Lowenstein, 2001, 26). Haghani gambled that investors had undervalued the Italian government as a credit risk over private sector banks (Lowenstein, 2001, 57). Later it was alleged that the Bank of Italy provided LTCM 'with market access and privileged information denied to Italian banks' to help manage Italian debt and get Italy into the European Common Market (Dunbar, 2000, 153). The deals were also implicated by Milan-based magistrates in high-profile corruption cases (Vukson, 2002, 132-133)

Instead of tracking between weaker and stronger currencies Haghani often tested a country against itself. The result was that by early 1997 Haghani's Italian trades 'earned a significant proportion of LTCM's profits' (Dunbar, 2000, 162). Yet another myth was that LTCM was unique. In fact Haghani's techniques were found in financial journals and also utilized by LTCM's competitors (Lowenstein, 2001, 59).

Foresight Systems and Strategic Alliances

LTCM was often critiqued, after its crash, for not having an adequate foresight system. But LTCM had one of the smartest and most experienced trading teams, including two Nobel laureates. Its financial modeling instruments were amongst the most complex. The reasons for the inadequate foresight were more than oft-cited hubris, 'mental model' blind-spots or 'architecture gaps' within international risk management. Likewise there were more layers than the 'investor-panic interpretation' that became common after the Asian currency crisis (Eichengreen, 2002, 141), and which was certainly true for fear-driven traders (Lowenstein, 2001, 173). Two key reasons were the limits of LTCM's models and its troubled relationship with investment banks.

LTCM's most secret tool was its trading modeling tool the 'Risk Aggregator' (Dunbar, 2000, 186). The 'Risk Aggregator' was 'a global radar system for the entire fund . . . firm-wide risk management' (Dunbar, 2000, 178). This system mapped out the 'implied volatility' of trades as a grid known as a 'volatility surface'. Other hedge funds had developed similar macro-trading systems which used statistical analysis for pattern recognition and longer-term trends (Temple, 2001, 62). In LTCM's system the 'short-dated index options' were closer to the present while 'long-dated options' stretched out into the future. (Dunbar, 2000, 168).

The model had crucial flaws. Its mathematical system didn't track geopolitical dimensions (Lowenstein, 2001, 55). The statistical data didn't go back as far as the 1992 and 1987 macroeconomic crises (Lowenstein, 2001, 146). Quantitative and portfolio techniques couldn't anticipate the qualitative shifts that Russia endured in its transition to free-market capitalism (Lowenstein, 2001, 140). LTCM's modelers hadn't explored the 'cross-impacts' of Asian and Russian crises or 'stress testing' scenarios for rare events (Dunbar, 2000, 138). The new reality was that in a 'world risk society' the 'impacts of risk grow precisely *because* nobody knows or wants to know about them' (Beck, 1999, 143). Hedge funds did use 'stop-loss points' which, to prevent a repeat of 'Black Monday', 'closed' a trade past a certain point (Temple, 2001, 62). The 'risk aggregator' was blamed, however, for LTCM's continued problems from August to October 1998 (Dunbar, 2000, 209). LTCM's fatal mistake was that the Efficient Market Hypothesis discounted the possibility that markets 'can occasionally be illogical for short periods' (Temple, 2001, 97). Also problematic was that international risk management in a 'world risk society' meant that everything is possible and consequently nothing can be predicted or controlled' (Beck, 1999, 114).

Meriwether's background viewed trading as a science rather than an art (Lowenstein, 2001, 63). LTCM used a 'mechanistic' model which valued interest-rate swaps and its likely losses on a usual trading day (Lowenstein, 2001, 138). In contrast George Soros' reflexivity viewed trading as an art and looked for outlying variables and freak events (Lowenstein, 2001, 149; Petersen). The 'Black-Scholes' equation had not been tested in a real market that faced the stress and volatility levels that LTCM faced (Lowenstein, 2001, 151). Even if its long-term outlook had been correct LTCM's leveraging meant it did not have the liquidity to survive. Finally one overlooked element was Fischer Black's death. Unlike his colleagues Black explicitly warned that 'believing too fervently in your own model was dangerous, because of the hidden assumptions involved' (Dunbar, 2000, 145). The 'two cultures' of quantitative

modeling and trading, open versus secretive, created a culture where constructive criticism became more difficult. The financial alchemy, like strategic planning implementations before it, created an animistic-like culture where the 'elders' made the rules (Stivers, 1999). Jim McEntree, a trader who did foresee trend changes, 'was ignored as a non-scientific, old-fashioned gambler' (Lowenstein, 2001, 134).

The driving force of this secretive culture was inter-firm competitiveness. LTCM used code-words for trading strategies and split 'each leg of a trade with a different broker' (Lowenstein, 2001, 48). This prevented LTCM's rivals from deducing its trading strategies and protected the fund's intellectual capital (Dunbar, 2000, 156). But LTCM also 'deftly exploited the banks' hunger for fees' (Lowenstein, 2001, 82) in a strategic move that echoed the 1980s mergers and acquisitions frenzy. In doing so LTCM became vulnerable at critical stress points. The firm relied on Bear Stearns to clear its daily trades (Lowenstein, 2001, 86) and this altered the 'balance of power'.

During the crisis Meriwether alleged that Goldman Sachs traders were 'front-running' or trading against LTCM due to inside knowledge (Lowenstein, 2001, 174-175). Warren Buffet and others conspired to 'drive LTCM out of business' (Temple, 2001, 106). Meriwether suggested that Goldman Sachs and other firms had 'sinister motives' because they wanted LTCM's intellectual capital for 'the bank's own equity derivatives traders' (Dunbar, 2000, 212). During negotiations with the Federal Reserve a 'bunker mentality prevailed' as LTCM senior partners blamed Goldman Sachs and other firms for conspiring against it (Lowenstein, 2001, 193). LTCM's initial secretiveness made raising Wall Street finance more difficult and its adulatory press coverage made the fund a target during troubled times.

Goldman Sach's defense was that it wasn't going to reinvest in LTCM so that its competitors could take the capital out (Lowenstein, 2001, 215). The firm criticized aspects of the 'Black-Scholes' equation (Kamal, 1998). LTCM's leverage was 'upwards of 25:1' (Temple, 2001, 98) and probably closer to 28:1. A subsequent Government Accounting Office report into LTCM disclosed that Merrill Lynch's leverage was 30:1 and Goldman Sach's was 34:1 (Temple, 2001, 159). The major investment houses also lost money: Goldman Sachs lost almost \$1 billion, Salomon lost \$1.3 billion and Merrill Lynch lost \$1.8 billion (Dunbar, 2001, 226). While LTCM was critiqued for its strategies the wider banking community's regular use of the same strategies has remained largely overlooked (Lowenstein, 2001, 232).

Anatomy of a Collapse

When the Thai stock market collapsed in 1997 Malaysia's Prime Minister Dr. Mohammed Mahathir blamed 'hedge fund attacks' (Dunbar, 2001, 176). Considering LTCM's profits from February 1994 until April 1998 made this argument compelling. LTCM had returned 20% (first year), 43% (second year) and 41% (third year) to its investors in dividends (Clark, 1999). LTCM's equity capital base in April 1998 was \$4.87 billion dollars (Dunbar, 2000, 185). It managed \$129 billion worth of assets against \$1.245 billion worth of liabilities and its 'off-balance sheet' derivatives position totaled \$1.25 trillion dollars (Dunbar, 2000, 190). London's traders had also renamed LTCM 'the Central Bank of Volatility' (Dunbar, 2000, 178).

Early warning signs occurred when LTCM lost \$772 million in May-June 1998 when 'the US mortgage market hit a rough patch' (Dunbar, 2000, 192-193). Traders also lost \$200 million on a 'sterling and deutschmark ten-year forward swap' (Dunbar, 2000, 204). They had not anticipated how a common European currency would change bond markets (Lowenstein, 2001, 113).

The Perfect Storm scenario zeroed in on 21 August 1998 as the day of LTCM's demise when the fund lost \$553 million in a single day (Lowenstein, 2001, 147; Dunbar, 2000, 205). The fund then lost \$227 million on 27 August 1998 (Lowenstein, 2001, 154). The fund lost \$530 million between 10 and 16 September 1998 (Lowenstein, 2001, 180). Salomon had assembled a rescue team, U.S. senators speaking out about the non-regulation of hedge funds, and the dystopian prospect of a financial meltdown (Lowenstein, 2001, 195). Equity volatility had reached the 'catastrophic level' of 38 percent (Lowenstein, 2001, 191). Finally the fund lost \$552 million on 21 September 1998 (Dunbar, 2000, 219). In one month LTCM 'lost \$1.85 billion in capital' and its 'net return was -44.78 per cent, which was a thirteen standard deviation event' (Dunbar, 2000, 208).

For the general public and the press LTCM's collapse signaled that 'billion dollar track records and Nobel Prizes are now meaningless' (Dunbar, 2000, 214). Scholes and Merton became convenient scapegoats. But although the press recognized a 'self-generated manufactured uncertainty' it did not always distinguish between 'decision-dependent risks and uncontrollable 'dangers' (Beck, 1999, 31). Scholes was aware that 'moral hazards' would distort LTCM's option trading strategies and didn't invest his Nobel Prize bounty in LTCM (Lowenstein, 2001, 119). Scholes and Merton had in fact been over-ruled in a crucial meeting about LTCM's liquidity position and their 'perceived bust of the arbitrage trading boom' (Dunbar, 2000, 196-197). Victor Haghani and Lawrence Hilibrand, two arbitrageurs who had followed Meriwether from Salomon's Arbitrage Group, dominated LTCM's trading strategies to the bitterness of other staff (Lowenstein, 2001, 129). Academia's real failure was an elite journal system which published 'only the approved academic theorists' and censored dissenters (Dreman, 1998, 284).

When it became clear that the investment banks would not bail-out LTCM the Federal Reserve's New York branch intervened. Peter Fisher, a Federal Reserve associate, assembled a meeting of twelve banks on 20 September 1998 (Lowenstein, 1998, 198-200). Fisher had discovered that the 'Risk Aggregator' had linked many of LTCM's trades to unprecedented volatility levels, exposed the fund in emerging markets and that the post-Russian default panic had scared counterparties into neutralizing their deals ((Lowenstein, 2001, 188). Fisher negotiated a \$3.65 billion bail-out by the banking consortium of LTCM's \$4.6 billion dollar losses (Dunbar, 2000, 223). The deal was signed on 28 October 2002 (Dunbar, 2000, 225). By the time that Federal Reserve chairman Alan Greenspan cut interest rates on 15 October 1998 the controversial hedge fund had recovered (Lowenstein, 2001, 188). But Meriwether and his colleagues felt constrained by the new oversight committee and restrictive trade rules. He left LTCM to found JWM Partners (Lowenstein, 2001, 235-236) and resurrected his career a third time. JWM Partners had, by July 2002, raised \$1 billion and returned a 6 percent dividend to investors (Hakim, 2002).

The Knowledge-Uncertainty Gap

Myron Scholes once described LTCM's trading strategy as 'earning a tiny spread on each of thousands of trades, as if it were vacuuming up nickels that others couldn't see.' After LTCM's bailout he felt that the 'Black-Scholes' equation was still powerful for problem-solving but its application 'was very difficult to effect' (Clark, 1999). Some analysts believed that 'it was not the models themselves that were at fault, but their application' (Paul-Choudry, 2002, 49). Others had concerns about the 'flight to quality' of investment capital in uncertain moments (Temple, 2001, 89). The growth of an offshore economy and the exploitation of state regulations meant the problems were more systemic than just the hedge fund industry (Palan, 1998, 66, 71). Financial globalization was in transition, crisis prone, deflationary and 'favored speculation . . . at the detriment of the 'real' economy' (Fontela, 1998, 757).

The widespread perception that LTCM's collapse could have triggered a 'cascading' financial meltdown was the first mass realization that global financial risks were 'a main factor in the drive towards a total economic collapse' (Beck, 1999, 111). This historical moment was the midpoint between the 1995-1998 collapses which had challenged international risk management and a more recent series of crises in Turkey, Argentina, Brazil and Venezuela (Eichenbaum, 2002, 164). Here risk perception 'determines thought and action' (Beck, 1999, 135).

This created a momentary focus on institutions and capacity-building (Eichengreen, 2002, 49). The Basel Committee on bank reform established a working group to examine hedge funds (Temple, 2001, 238) and the Bank of International Settlements issued a report on how LTCM's crisis had affected the interbank market (Furfine, 1999). Meanwhile Federal Reserve Board Chairman Alan Greenspan defended the negotiated bailout to U.S. Congress as necessary (Singh, 2000, 200-201). Greenspan criticized how other investment banks had adopted LTCM's trading in a 'me too' pattern that exacerbated the collapse (Temple, 2001, 104). Debtor nations attacked the United States for its inherent claim of moral superiority (Temple, 2001, 110) and the perceived 'doublespeak' about meeting financial obligations (Singh, 2000, 200-201). Joseph Stiglitz, the World Bank chief who had monitored the Asian currency crisis and the Russian default, resigned in January 2000 and offered a scathing critique of International Monetary Fund policies (Stiglitz, 2002). Specific initiatives have been proposed like a 'foreign exchange transaction reporting system' to protect Central Banks against traders (Kay and Henderson, 1999) have been outlined but not yet implemented.

The post-LTCM debate about international risk management remains ongoing as the global financial system is still in a transition period. Already it is clear that key institutions missed the 'reform option' in late 1998 to overhaul the post-Bretton Woods monetary system. Financial liberalization has come under attack from the anti-globalist movement. Futures and foresight literature, meanwhile, has increasingly focused on qualitative methods, surveying global crises and 'capacity building' within corporations and communities. The multiple ironies—that reputations and low-risk strategies contributed to the fund's downfall—are probably Long-Term Capital Management's most enduring legacy (Temple, 2001, 89). Foresight practitioners contemplating organizational interventions, emancipatory campaigns or creating 'institutions of foresight' should take heed of LTCM's mistakes.

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