A publication of the School of Business at Loyola University Chicago

RMRR
RISK MANAGEMENT
RESEARCH REPORT

http://www.RMRR.com

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Risk Management Research Report is published quarterly to serve the professional and academic risk management communities by presenting extended summaries of recently published academic articles of particular interest.

RMRR seeks to select the best and most important articles in risk management and corporate governance and to communicate the essential ideas of that research to risk managers and risk management scholars in a timely manner and a convenient format.

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Winter 2010

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RMRR is supported by the Center for Integrated Risk Management and Corporate Governance at Loyola University Chicago

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Why Do U.S. Firms Hold So Much More Cash Than They Used To?

Thomas W. Bates, Kathleen M. Kahle, and René M. Stulz

The Journal of Finance, October 2009, 64:5, 1985-2021.

Thomas Bates, Kathleen Kahle, and René Stulz (BKS), address a problem that has garnered significant attention from the popular financial press—the large increase in cash holdings of U.S. firms over recent decades. BKS adopt 1980-2006 as their data period and use CRSP and Compustat for surviving and non-surviving firms; they exclude financial firms and utility companies; and they restrict the sample to firms incorporated in the U.S. This yields a data set of 13,599 unique firms with a total of 117,438 annual observations.

They document a large increase in cash holdings for U.S. firms from 1980-2006, noting that the average cash-to-assets ratio has more than doubled over this period. One potential explanation for increasing cash is the prevalence of agency problems, but in the absence of agency issues, the need for cash should have fallen given the improvements in information and financial technology over this period. BKS set out to understand this anomaly.

Measuring leverage as debt-to-assets or debt-to-equity, there has been little decrease in average leverage. But the net debt ratio (debt minus cash, divided by book assets) has fallen sharply: "The fall in net debt is so dramatic that the average net debt for U.S. firms is negative in 2004, 2005, and 2006." (1986)

In the finance literature, there are four well recognized motives for holding cash: transactional, precautionary, tax-oriented, and agency problem. BKS argue that cash management systems have improved over their sample, so they discount the transactional motivation. Increasing robustness of derivatives markets and improvements in forecasting and control technologies should have reduced the precautionary motive over this period. Offsetting these factors that predict reduced precautionary balances, there has been an increase in idiosyncratic risk for firms over this period, suggesting greater problems with unhedgeable risks and an increased need for precautionary balances. U.S. firms with foreign profits hold cash to avoid repatriating funds and paying taxes, which might increase cash balances. Finally, entrenched managers might be inclined to hoard cash even when they lack good investment opportunities, so agency problems might account for increased cash holdings.

BKS are able to discard some potential explanations. They find that firms of different sizes all exhibit the increase in cash, with the average cash ratio increasing for all firm size quintiles. The sample period included the IPO surge of the 1990s, and IPO firms might have more cash when they issue seasoned equity after the IPO. However, cash holdings of both IPO and non-IPO firms increase, leading BKS to conclude: "…the increase in cash holdings we document is not due to the capital raising activities of the IPO firms in our sample." (1995)

Further, contrary to the tax motivated hypothesis, BKS show that firms without foreign income also exhibit increased cash holdings. The authors also find that firms with managers that are most entrenched have the smallest increase in cash holdings, contrary to the agency explanation.

BKS find that the increased holding of cash is related to the "disappearing dividends" phenomenon. For non-dividend paying firms there is a strong increase in the mean cash ratio, and the net debt ratio falls for these firms as well. This is not observed for dividend-paying firms.

Non-dividend firms are generally regarded as more cash-constrained, so this contrast suggests that a precautionary motivation is at play. BKS also find that firms with higher idiosyncratic risk hold more cash. In addition, the fall in capital expenditures, accompanied by increased research and development expenditures, is also related to increased cash holdings.

BKS conclude: "We find that the main reasons for the increase in the cash ratio are that inventories have fallen, cash flow risk for firms has increased, capital expenditures have fallen and R&D expenditures have increased." (2018) Thus, "…the precautionary motive to hold cash is a critical determinant of the demand for cash." (2019)

Errors, Robustness, and the Fourth Quadrant

Nassim Nicholas Taleb

International Journal of Forecasting, October 2009, 25:4, 744-759.

Nicholas Taleb stresses that the use of forecasts should be based on the estimate accuracy of the forecast, and asserts that there is an "…interdependency about what we should or should not forecast—as some forecasts can be harmful to decision makers." (745) This general principle is related to the distribution about which a forecast is made and turns on the nature of the tails of the distribution. Distributions with thin tails make forecasting easy, but thick tails make forecasts more fragile, as it is harder to understand the forecast errors associated with forecasts about such distributions.

Taleb uses empirical data as a basis from which to generalize and to illustrate his theoretical points. He examines daily data for many years for 38 economic variables that represent the vast majority of all tradable assets and include a variety of currencies, commodity futures, bonds, metals, exchange rates, and stock indexes.

He computes daily logarithmic returns for non-overlapping horizons of 1, 10, and 66 days and tests the returns distributions for non-normality using the fourth non-central moment, which captures the excess kurtosis of the tested distribution over the kurtosis of a normal distribution.

Based on this analysis, he concludes that all of these economic variables "…are patently fat-tailed—with no known exceptions." (746) The departure from normality persists whether one considers 1, 10, or 66 day intervals. As a consequence, he argues that conventional methods such as linear regression and Gaussian copulas are unworkable, because they cannot capture the fat tails of the actual distributions.

For forecasting, the main problem is that it is difficult to estimate small probabilities, so that forecast error rates for small probability events will be greater than those for higher probability events. This can be disastrous when the small probability events have a large impact, a point that Taleb illustrates by saying "…while it is acceptable to take a medicine that might be effective with a 5% error rate, but offers no side effects otherwise, it is foolish to play Russian roulette with the knowledge that one should win with a 5% error rate…" (748) Thus, low forecast error rates for events that occur with low probability, but high impact, can lead to terrible decisions. So, forecast accuracy and decision quality are interdependent. This leads Taleb to focus on what he calls the "fourth quadrant"—"…the area in which both the magnitude of forecast errors is large and the sensitivity to these errors is consequential." (748)

Some types of decisions are easy, when they turn on the zeroth moment, merely the probability of events and not their magnitude. These arise in binary payoff situations, such as matters of truth or falsity or winning or losing an election. Also manageable are those situations with linear payoffs, such as predictions in finance generally, matters of climate, and the occurrence of epidemics. Problems arise when decisions turn on higher moments that have non-linear payoffs, such as the payoffs of derivatives and leveraged portfolios.

Forecasting is safe for binary decisions about thin-tailed (Type-1) distributions (first quadrant), and is workable for complex decisions about thin-tailed distributions (second quadrant). For simple decisions about fat-tailed (Type-2) distributions, normal statistical methods also work well, even though pitfalls are present. Even for simple decisions about Type-2 distributions (third quadrant), forecasting is valuable because the tails of the distribution have little impact on the payoff.

The real problem arises in the fourth quadrant, complex decisions for Type-2 distributions. Here forecasting fails to lead to good decisions. In such situations, one must avoid the fourth quadrant.

Taleb's main idea is "…to endogenize decisions, i.e., escape the 4th quadrant whenever possible by changing the payoff in reaction to the high degree of unpredictability and the harm it causes." (755) For example, one should transact to cap potential losses of a transaction.

Stock Market Liquidity and Firm Value

Vivian W. Fang, Thomas H. Noe, and Sheri Tice

Journal of Financial Economics, October 2009, 94:1, 150-169.

Vivian Fang, Thomas Noe, and Sheri Tice (FNT) explore the relationship between stock market liquidity and firm performance. There have been a number of theoretical analyses of the effect of liquid markets on firm performance, including suggestions that liquid markets help promote more efficient management compensation, reduce managerial opportunism, and stimulate trading by informed investors, which improves investment decision making through share prices that convey more information.

In contrast to these theoretical studies, FNT offer an empirical examination of the effect of stock market liquidity on firm performance.

FNT draw data for their study from numerous sources including CRSP, Compustat, Institutional Brokers Estimates System, Investor Responsibility Research Center (IRRC), and the Trade and Quote database. Because they are interested in firm performance, FNT use annual firm data. Due to data limitations from IRRC, the authors restrict their sample to six years: 1993, 1995, 1998, 2000, 2002, and 2004. This yields a final sample of 2,642 firms with 8,290 firm-year observations.

FNT use Tobin's *Q* (broadly, the ratio of market value to book value) to gauge firm performance. They measure liquidity as the "relative effective spread," which is based on the execution price and the mid-point of the prevailing bid-ask quote. The effective spread is the difference between the execution price and this mid-point, with this quantity being divided by the mid-point. The relative effective spread is the effective spread standardized by the stock price level. FNT also use a number of control variables including a measure of leverage, an index of shareholder rights, stock market momentum, firm size and age, Delaware incorporation, S&P 500 inclusion, and so on.

They regress *Q* on the liquidity measure and the control variables for each year individually and for the pool of six years of data. The relationship between *Q* and liquidity is strongly positive in all cases, showing that higher stock market liquidity (a lower spread) is correlated with higher firm performance as measured by *Q*. The effect appears economically significant as well, with an increase in liquidity of one standard deviation leading to an increase in *Q* of 0.61. FNT also use alternative liquidity measures and find their results to be robust.

A number of control variables are also highly significant showing that: "weaker shareholder rights are correlated with lower firm performance," "small companies have higher performance," "S&P 500 companies have higher firm performance," "younger firms tend to have higher firm performance," and "the more analysts following a stock the higher the firm's *Q*." (158)

While the statistical correlation between liquidity and higher firm performance, *Q*, is strong, there is a question of the direction of causality. Does stock market liquidity contribute to firm performance or are the stocks of strongly performing firms more liquid?

FNT examine this issue by focusing on the decimalization of stock prices: "The change in liquidity surrounding decimalization is used as an instrument for liquidity to document that stocks with a larger increase in liquidity following decimalization have a larger increase in firm performance." (151) FNT regress the change in *Q* on the change in liquidity occurring at decimalization, which leads them to conclude: "An increase in liquidity surrounding decimalization results in an increase in firm *Q*." (162)

FNT conduct a number of sub-analyses based on decomposing *Q* into price-to-operating earnings, financial leverage, and operating profitability. They find that liquidity enhances firm performance through higher operating profitability, which leads to an enhanced value of performance-sensitive managerial compensation.

Also, "…information feedback from stock prices to firm managers and other stakeholders is one mechanism responsible for better firm performance for firms with higher stock market liquidity." (167)

Credit Contagion from Counterparty Risk

Philippe Jorion and Gaiyan Zhang

The Journal of Finance, October 2009, 64:5, 2053-2087.

Philippe Jorion and Gaiyan Zhang (JZ) explore the problem of historically observed clusterings of default or "credit contagion," which "…arises when the default of one firm causes financial distress for its creditors." (2054) This empirically observed phenomenon of contagion exposes a significant weakness of standard credit risk models which are unable to explain such contagion.

JZ examine a sample of 251 Chapter 11 bankruptcies from 1999-2005, which are drawn from 146 industries, involved 570 creditors, and represent a total credit amount in excess of $8 billion. JZ focus on the bankrupt's largest twenty creditors. Data for the study come from the website www.bankruptcy.com. Company and stock data sources are from CRSP and Compustat, while they drew information on the credit default swap (CDS) spreads from Markit.

Importantly, this sample includes both industrial and financial creditors. Industrial creditors are exposed to bankruptcies largely through the extension of unsecured trade credit. But industrial creditors also have potentially important exposure due to business relationships, which can be disrupted or even terminated by the bankruptcy. Thus, for industrial creditors, a bankruptcy can mean not only the loss of value from the extension of credit, but also the loss of a business relationship.

By contrast, financial creditors, such as banks, have generally made loans to the firms that go bankrupt. Relative to its own size, industrial creditors generally have greater exposure to a bankrupt firm than do financial creditors. This is due to the generally large size of banks and the limits on lending to a single borrower that banks face.

The key analysis employs a standard event methodology. JZ analyze the effect of the announcement of a bankruptcy on the stock prices and CDS spreads of creditors. To isolate the credit contagion effect of the bankruptcy, JZ also control for industry effects on the movement of stock prices and for credit rating effects in the case of CDS spreads. As they expected, JZ find that the announcement of the bankruptcy brings a negative stock price response and an increase in the CDS spread for creditors.

For an 11-day window around the bankruptcy announcement, JZ find an abnormal equity return for creditors of -1.9 percent, after adjusting for industry and credit rating effects. "This translates into a loss of $174 million for the median creditor." (2056) For creditors, the CDS spread increases by five basis points on average. This CDS spread effect is statistically significant but small. (JZ note that the CDS spread difference between BBB and BBB- instruments is 28 basis points.)

JZ also track the ongoing effects of the bankruptcy on the creditors and find that creditors with large exposures are more likely to fail themselves. They further find that "…these counterparty effects are reliably associated with a number of variables, including the relative size of the exposure, the recovery rate, and previous stock return correlations." (2056) The deeper the business relationship between the failing firm and the creditor, the greater is the counterparty effect: "…the counterparty effect is considerably stronger when the debtor is a major customer of the creditor, and when the debtor liquidates rather than when it reorganizes because the creditor incurs a loss not only from its current exposure but also from future business." (2056)

Consistent with this finding, JZ discover that the overall wealth and distress effects are greater for industrial rather than financial creditors. In sum, "The results indicate that counterparty risk does affect the shape of the default distribution, thus providing a potential explanation for the observed default clustering." (2056)

Cross-Section of Option Returns and Volatility

Amit Goyal and Alessio Saretto

Journal of Financial Economics, November 2009 94:2, 310-326.

Much option speculation focuses on volatility, and these trades imply that the market's expectation of future volatility is erroneous. Believing that "…volatility misestimation is the most obvious source of options mispricing" (310), Goyal and Saretto (GS) focus on gaps between historical volatility (HV) and implied volatility (IV), and offer a conjecture "…that large deviations of IV from HV are indicative of option mispricing." (311)

To analyze such a strategy, GS sort stocks according to the difference between HV and IV, and they compute returns of straddles and delta-hedged call portfolios. They estimate HV using daily realized stock returns over the prior 12 months, and their measure of IV is the average of the implied volatilities for the call and put contracts closest to the money one month before expiration.

GS draw their option data from the OptionMetrics Ivy DB database, which includes daily bid and ask quotes for options and their IVs. Their sample period is 1996-2006 and covers 4,344 stocks, yielding 75,627 month-pairs of call and put contracts. For their decile portfolios of options, the difference between HV and IV ranges from -0.148 to 0.197.

They report for their option straddle trades: "We find that a zero-cost trading strategy involving a long position in an option portfolio of stocks with a large positive difference between HV and IV and a short position in an option portfolio of stocks with a large negative difference generates statistically and economically significant returns." (311) Across their deciles, these monthly straddle returns range from -12.8 percent to 9.9 percent.

They find similar results for delta-hedged calls: "… we find statistically and economically significant positive returns for high decile portfolios and negative returns for low decile portfolios of delta-hedged calls." (311) While the returns from the hedge portfolios are lower than those of the straddles, they are still economically large.

GS find that their results are robust with respect to various sample periods and alternative volatility measures. They consider trading costs and take into account the capital demands of margin requirements, but their strategy still results in economically important profits. GS find that the returns to their option strategies covary with some stock characteristics that help to explain stock returns, but they judge that "…this covariance is not enough to explain the high realized returns to our strategy." (311)

GS seek to understand their unusual results by further examining changes in volatility that lead to the deviations between HV and IV. These large deviations between HV and IV are transitory and the emergence of these deviations is driven by extreme patterns in stock returns. The pattern of deviations is consistent with investors who overreact to a recent sharp stock price movement.

Thus, they rapidly adjust their estimates of future volatility, causing the sharp divergence between HV and IV. The question is whether these sharp divergences are rational. That is, do investors rapidly adjust their estimates of future historical volatility (the new IV) to the correct level? GS find that these large deviations are, in fact, short-lived. GS also find that "…future realized volatility does not change by as much as predicted by IV." (325)

This apparent overreaction is inconsistent with the traditional finance view of rational investors, but it can be accommodated within a behavioral finance approach. GS refer to a behavioral model by Barberis and Huang (*Journal of Finance,* 2001) in which investors form future volatility estimates that are overreactions to recent stock price changes. For GS, their empirical results are broadly consistent with the model of Barberis and Huang.

The Financial Crisis, Systemic Risk, and the Future of Insurance Regulation

Scott E. Harrington

The Journal of Risk and Insurance, 2009, 76:4, 785-819.

Scott Harrington focuses on the role of AIG in the financial crisis of 2007-2009 and the surge of interest in increasing regulation of insurance companies. He examines the potential systemic risk posed by insurance companies and the need for insurance companies to fall under the purview of a systemic risk regulator. After surveying some of the general causes of the financial crisis, Harrington turns to the role of the insurance sector in the crisis and concludes that "…the insurance sector as a whole was largely and perhaps remarkably on the periphery of the crisis." (788)

The apparent counterexample to this claim is AIG, which Harrington examines at some length, noting that AIG's problems were not closely related to any insurance activity, but were largely confined to AIG's financial products division with its trading of credit default swaps along with its securities lending operation.

Harrington notes that some life insurers have faced considerable distress and sought funding under TARP (Troubled-Asset Relief Program), but the participation of these firms in TARP was "negligible." (788) Monoline mortgage and bond insurers suffered large losses and credit downgrades, yet none has received bailout funding and none has failed to date.

In an extended examination of AIG's financial problems during the crisis, Harrington traces AIG's problems to areas beyond the regulated insurance subsidiaries. Nonetheless, Harrington points out that all aspects of AIG were subject to regulation: "…as a consequence of owning a savings and loan subsidiary, AIG was subject to consolidated regulation and oversight by the OTS [Office of Thrift Supervision]. . ." (799) Further, Harrington quotes testimony of OTS Acting Director Scott Polakoff, who said: "…OTS maintained a contemporaneous understanding of all material parts of the AIG group, including their domestic and cross-border operations." (799)

Harrington notes the considerable literature that agrees that systemic risk is relatively low in insurance markets compared to banking. This is especially true for property-casualty insurance, but holds well also for life insurers. Further, Harrington notes, problems with insurance firms do not threaten the financial payments system. During 2009, a variety of policy proposals called for increased regulation of insurers as do some pieces of proposed federal legislation. These include optional and mandatory federal chartering, the designation and regulation of some insurers as "systemically significant," and the inception of active federal regulation of the insurance industry. For example, the Office of National Insurance Act of 2009 calls for the formation of an Office of National Insurance (ONI) to "monitor all aspects of the insurance industry." (806) The Bean-Royce Federal Charter Bill would create an optional federal chartering system and lodge an ONI within Treasury.

Harrington concentrates on the desirability of bringing insurance markets under the purview of a systemic risk regulator. Harrington argues that designating an insurance company as "systemically significant" would make it "too-big-to-fail" (TBTF), that such a designation would lead to implicit or explicit government guarantees of the obligations of such firms, that it would lead to competitive imbalances between the "systemically significant" firms and the others, and that "systemically significant" firms would have incentives to alter their financial and operating decisions in undesirable directions.

Further, Harrington believes that the urge for greater regulation of insurers does not adequately consider the costs and benefits of such a regulatory regime, that it does not consider the failure of such regulators to prevent the financial crisis in the banking sector, that it ignores the modest role of the insurance sector in the recent crisis, and that it provides no guidance for limiting the scope of discretionary federal authority.

In sum: "As a result of these considerations, creation of a systemic risk regulatory for insurers and other nonbank institutions designated as systemically significant would not be good policy. It would instead illustrate the adage that 'bad policy begets bad policy'." (808)

Risk Management Lessons from the Credit Crisis

Philippe Jorion

European Financial Management, November 2009, 5:5, 923-933.

Philippe Jorion seeks to evaluate the role of risk management systems in the financial crisis of 2007-2009. He notes that risk measures have typically been built using returns-based information, so they are backward-looking, easy and cheap to implement, and reflect the dynamic trading of the portfolio. However, such measures offer no guidance for innovations in instruments, markets or managers, and they are slow to identify style drift. In short, "…returns-based risk measures give no insight into the risk drivers of the portfolio." (925) By contrast, all modern risk management systems employ position-based risk measures, which use the most current information on a bank's investment positions.

As such they are immediately applicable to new instruments, markets, and managers, and can be used for forward-looking stress tests. The drawbacks of position-based systems are that they are static over the risk management horizon and fail to reflect dynamic trading. Also, they are susceptible to data and modeling error and are expensive. Nonetheless, Jorion notes that "…all modern risk management architectures rely on position-level information." (925)

In classifying risk management problems, Jorion refers to Donald Rumsfeld's classification of risks as known knowns, known unknowns, and unknown unknowns. Known knowns characterize a "flawless risk measurement system." (926) Large losses do not necessarily imply the failure of such risk management systems. For example, a risk management system may assess risks perfectly, but managers may adopt positions of high risk that lead to large losses, or they may simply experience bad luck. Similarly, experience may conform to the frequency of value-at-risk (VAR) estimates, but may just be extreme.

For known unknowns, actual risk management systems are susceptible to model errors, such as ignoring important known risks or measuring risks (such as correlations and volatilities) inaccurately. These kinds of model errors played a role in the crisis. For example, buying a corporate bond and a related credit default swap (CDS) should be an arbitrage trade. However, mapping both instruments to the same risk factor ignores the basis risk. In 2008, the basis widened substantially leading to large mark-to-market losses. Similarly, if the parameters of the risk model are estimated with data from a low-risk period, the impression from these estimates may lead to a bank's adopting high leverage that is unsuitable to a future higher risk environment. Similarly, correlations among mortgage-based assets were estimated from a long historical period with uniformly rising real estate prices, which led to thin capitalization of mortgage-backed security positions.

In addition, risk management systems are beset by unknown unknowns—"…events totally outside the scope of most scenarios." (929) Even for a bank that knows its counterparties, there can still be network externalities, because a bank is implicitly exposed to the risk of the bank's counterparties' counterparties. Thus, "Understanding the full consequences of Lehman's failure would have required information on the entire topology of the financial network." (929) As a consequence, banks are exposed to systemic risk, for which they cannot possibly carry sufficient capital. Jorion believes that these problems emphasize the deficiency of economic capital analysis.

Jorion draws some lessons for future risk management. He believes that banks should develop forward-looking scenarios and stress test their models. For some banks (e.g., UBS) such a practice would have revealed flaws in their risk management systems. Firms with hierarchical management structures did not encourage feedback from risk management systems, and failed to develop their own valuation models, relying on credit ratings instead. For the future, Jorion advocates overweighting recent data in risk models, using stress tests, and developing broader scenario analysis. He points out that all such methods require a position-based risk management system and concludes that the crisis has reinforced the importance of risk management. "Risk management will not go away as a core function of financial institutions." (933)

The Crisis in the Foreign Exchange Market

Michael Mervin and Mark P. Taylor

Journal of International Money and Finance, December 2009, 28:8, 1317-1330.

Michael Mervin and Mark Taylor (MT) examine the behavior of the foreign exchange market during the financial crisis that began in 2007. Their aim is "…to catalogue all that was truly of major importance in this episode." (1317) They also construct an index of financial stress for foreign exchange (FX) and use this as a basis to compare dislocation in the FX market across several crisis episodes. Finally, they discuss whether it might have been possible to predict the dislocations that occurred in the recent crisis.

MT provide a chronicle of events in the FX market associated with the crisis and portray the FX market as having been beset by four special crisis episodes from 2007 to early 2009. These occurred in August 2007 with contagion from other asset classes, a major unwinding of the carry trade and large deleveraging in FX in November 2007, a sharp reaction in March 2008 that accompanied the demise of Bear Stearns, and, most spectacularly, an extreme reaction in September 2008 as Lehman Brothers fell into bankruptcy.

The financial crisis beset the FX market rather late, after the equity markets had already suffered large losses. MT date the beginning of the crisis for FX to August 2007, and more particularly to August 16, 2007: "…on this date a major unwinding of the carry trade occurred and many currency market investors suffered huge losses." (1318) In the run up to August, currency volatilities increased from a typical annualized standard deviation of around 8 percent to 28 percent.

Focusing on the Australian dollar (a high interest rate currency) and the Japanese yen (the premier low interest rate currency), MT note: "…the 1-day change in the JPY price of the AUD on August 16, 2007 was -7.7%…" (1318) which compares to a normal one-day fluctuation of 0.7 percent. The market then enjoyed relative calm for several months.

From November 7 to November 12, 2007, the AUD/JPY exchange rate fell about 9 percent, and volatility surged. MT trace this episode to dislocation in credit markets, which resulted in forced liquidations of some positions to reduce leverage. A comparable surge in FX dislocation occurred in March 2008, but the resolution of Bear Stearns calmed markets: "Once it was clear that Bear would be sold and not go bankrupt, credit risk receded and remained fairly low through the summer." (1321)

The largest shock to the FX market paralleled the death throes of Lehman Brothers in September 2008. Compared to November 2007 and March 2008, volatility was more than double, as was the TED spread (the yield difference between U.S. treasuries and LIBOR). MT describe these volatility levels as "incredible" (1322), and they mince no words in assessing the policy decision of the Federal Reserve and the U.S. Treasury that allowed Lehman to go into bankruptcy: "This ultimately turned out to be a disastrous decision that imposed losses on other firms across the industry and created turmoil not seen before." (1322)

MT also create a "financial stress index" in the spirit of a proposal by the International Monetary Fund. The index is based on 17 major currencies and reflects risk measures from the banking sector, the securities market, and the FX market. They show that from 1982-2008 the two greatest periods of stress occurred with the Russian default in 1987 and with the Lehman episode, with Lehman taking honors by a relatively small degree. MT also show the returns to the carry trade from 2000 through the crisis. In spite of being consistently profitable for most of the period, the strategy earned a negative cumulative return if held for the entire period.

An Empirical Comparison of Option-Pricing Models in Hedging Exotic Options

Yunbi An and Wulin Suo

Financial Management, Winter 2009, 38:4, 889-914.

Since the development of the Black-Scholes option pricing model (BS), a number of other models have been developed, including jump diffusion models (JD), stochastic volatility models (SV), and models that incorporate both stochastic volatility and jump diffusion features (SVJ). As applied to "plain vanilla" options, some of the successors outperform BS on pricing, but all seem to perform similarly in hedging effectiveness.

Yunbi An and Wulin Suo (AS) test the hedging effectiveness of these four models in hedging exotic options, such as barrier and compound options. Testing exotic options to assess hedging effectiveness presents these models with a higher hurdle, because exotic options are "…more sensitive to model misspecifications and could be seriously mispriced or mishedged by a model that might otherwise accurately value European options." (890)

As exotic options trade over-the-counter, historical data are not available, so AS test a synthetically created exotic option. For a given option and its price, AS use the various models to infer the parameters of the model, and they measure hedging effectiveness from the perspective of a trader seeking to minimize risk through dynamic hedging. For barrier options, AS focus on up-and-out calls, and for compound options they concentrate on call-on-call options.

Data for the study were downloaded from the website of the British Bankers' Association and include the EUR/USD Currency Option Volatility Index and LIBOR rates for the dollar and euro from 2002-2007. AS use these data to generate 23,307 option prices, with 17 observations per day. To test hedging effectiveness, AS use two dynamic hedging strategies, a minimum variance strategy and a delta-vega neutral hedging strategy.

For the minimum variance strategy, AS find that the SV model generally outperforms the BS model in hedging most up-and-out calls. "This suggests that incorporating the stochastic volatility into the model framework significantly improves the performance of hedging these types of barrier options…" (904) However, the BS model performs about the same for hedging long-term out-of-the-money options. AS document wide variation in hedging effectiveness as the moneyness and maturity of the barrier options vary. In general, they confirm that "…model performance depends on the degree of path dependence of the exotic option considered." (906)

Not surprisingly, hedging performance is worse the lower the knock-out price, and AS find that for in-the-money options "…hedging performance also deteriorates as the maturities increase for any given barrier level." (906) Call-on-call options with low strike prices and longer maturities are easier to hedge. That is, the hedging errors are smaller for these options. AS find similarly diverse results for delta-vega hedging strategies.

One of the main conclusions reached by AS is that "…the performance of the alternative models relative to the BS model depends on how 'exotic' the hedged option is. Barrier options are more path dependent than compound options; therefore, the model's relative performance of hedging barrier options is quite different from that of hedging compound options." (912) For most up-and-out calls, the SV outperforms the BS model, but the JD and SVJ perform poorly. But for hedging call-on-call options, these alternative models perform better.

They also conclude that "…choosing a suitable model is particularly important for hedging different types of exotic options." (912) Further, the hedging effectiveness of all models deteriorates the more exotic the options become: "For hedging up-and-out calls, both the barrier level and the maturity have a great impact on the hedging effectiveness. It is most risky to hedge up-and-out calls with a very low barrier level, and the hedging errors increase with the maturities for ITM [in-the-money] up-and-out options." (912)

Quantifying the Interest Rate Risk of Banks: Assumptions Do Matter

Oliver Entrop, Marco Wilkens, and Alexander Zeisler

European Financial Management, November 2009, 15:5, 1001-1018.

Entrop, Wilkens, and Zeisler (EWZ) analyze the "standardized framework" (SF) proposed by the Basel Committee on Banking Supervision in 2004, which seeks to quantify the interest rate risk of banks. While Basel II establishes mandatory capital requirements for credit and operational risk, there are no mandatory capital requirements for interest rate risk.

In contrast to credit and operational risk, interest rate risk falls under pillar 2 of Basel II, the "supervisory review process." These principles for managing and supervising interest rate risk call for particular attention to "outlier banks"—those "whose economic value in relation to regulatory capital declines by more than 20% if a 'standardised interest rate shock' occurs." (1002) This shock is a parallel shift in the yield curve of 200 basis points in either direction. This approach has been incorporated into law in many countries including Germany. If assumptions incorporated in the SF are inadequate or too simplistic, poor supervision and faulty risk management may result. EWZ seek to test the adequacy of the SF's assumptions.

The SF operates via the bucketing of interest-rate sensitive assets and liabilities into 13 time bands of remaining time to maturity for fixed-rate instruments and for the repricing period of floating rate instruments. Bands range from less than one month, up to a period in excess of 20 years. The SF then uses duration technology to calculate interest rate risk.

EWZ generalize the SF to allow them to analyze the model's assumptions on the estimation of interest rate risk, and they test the effect of these assumptions using data on the German universal banking system provided by the Deutsche Bundesbank. These data cover more than 90 percent of all assets and liabilities, but do not reflect derivatives positions.

As German banking supervisors use only four time bands, EWZ develop a model to allocate assets and liabilities to the more fine-grained time bands of the SF. Using their simulation of the SF, EWZ find that the interest rate risk of the German universal banking system is 30.9 percent, meaning that the standard interest rate shock (200 basis points) would cause a gain or loss of 30.9 percent of the banking system's capital. (Derivatives are omitted, which would presumably have cushioned this sensitivity.)

EWZ find that even slight modifications of the SF's assumptions make the measured sensitivity of the banking system change radically. For example, the SF assumes that the relevant modified duration of savings deposits is 2.5 years, but changing this to either five or zero years makes the interest rate risk swing from 40.9 to 20.9 percent, respectively.

The SF assumes that all of the instruments in a given time band are concentrated at the mid-point of the band. (The same is true of the system used by the Federal Reserve in the U.S.) Varying assumptions about how instruments are distributed within each time band can have very large effects on the measured interest rate risk. For example, "Assuming actual German reporting practices, the estimation of the interest rate risk may vary by up to 28 percentage points." (1012)

Beyond assuming that maturities are located at the center of the various time bands, the SF assumes that amortization rates are zero and that coupon rates equal market interest rates. EWZ find that these assumptions are also singly important, and that varying these assumptions strongly affects interest rate risk estimates. Varying conditions of maturities within time bands, number and breadth of time bands, amortization rates, and coupon rate divergences from market rates have very large effects taken together.

EWZ conclude that "…the standardised framework can misjudge the level of interest rate risk of banks by a considerable amount if a bank's structure differs from the Committee's assumptions." (1016), that "…the Committee's model cannot be expected to appropriately distinguish between low-risk and high-risk banks," (1016) and that "…the standardized model cannot reliably identify the outlier banks that supervisors should pay special attention to." (1016)

Currency Carry Trade Regimes: Beyond the Fama Regression

Richard Clarida, Josh Davis, and Niels Pederson

Journal of International Money and Finance, December 2009, 28:8, 1375-1389.

Richard Clarida, Josh Davis and Niels Pederson (CDP) explore the persistent failure of uncovered interest rate parity: "In a risk-neutral world the forward exchange rate should be an unbiased predictor of the future spot exchange rate." (1375) Instead, this is a prediction that has consistently failed: "Today, just as 25 years ago, papers continue to find that currencies with high interest rates tend on average to appreciate relative to currencies in countries with low interest rates." (1375)

"This stylized fact constitutes the forward rate bias puzzle." (1375) The persistence of this stylized fact has driven a consistently successful investment strategy, the "carry trade": "…investors can make systematic profits by shorting the low yielding currency and taking a long position in the high yielding currency." (1376)

Using data from Bloomberg, CDP first document the persistent profitability of the carry trade. Focusing on the period from 1992-2009 and restricting the analysis to the currencies of G10 countries, CDP form long/short currency portfolios by shorting the low interest rate currency and taking a long position in the high interest rate currency.

They do this for one-currency portfolios (lowest interest rate currency vs. highest interest rate currency), two-currency portfolios (two lowest vs. two highest), and so on up to five currency portfolios, which exhausts the G10. These portfolios exhibit strong positive returns, on average, over the entire period. This is true even omitting portfolios formed with the Japanese yen, which has had extremely low interest rates for the last few decades.

CDP find that forming multi-currency portfolios provides a significant diversification benefit, but that there is a cost in terms of achieved returns. They also find: "Overall, the returns to currency carry portfolios are positive with Sharpe ratios that are comparable or superior to those on equity investments…" (1378), and that this is true both with and without the yen and the dollar in the portfolios. However, against the background of overall large positive average returns from the carry trade strategy, CDP also document significant periods of sharp losses for such strategies.

This leads to a consideration of the relationship between carry trade returns and exchange rate volatility, for which they conclude: "The implication of this co-movement is that when the carry returns are high, return volatilities are low and vice versa." (1380) Dividing the days in their sample into quartiles based on exchange rate volatility, CDP find that the high volatility days are associated with negative carry trade returns, while low volatility days generate positive carry trade returns.

The "Fama regression" relates changes in the spot exchange rate to a constant and the lagged differential in exchange rates implied by covered interest rate parity between a high and low interest rate currency. If uncovered interest rate parity holds, the coefficient in this regression should equal unity. Numerous studies have found a significantly negative coefficient for this regression, which CDP confirm.

However, for separate samples of high and low volatility days, CDP find: "…the estimated coefficient on the interest differential changes from being significant and very negative for the low volatility state to significant and very positive in the high volatility state." (1384)

Finally, CDP also examine the relationship between returns on the carry trade and the yield curve for the two currencies. "We showed that yield curve level factors are positively correlated with carry trade excess returns while yield curve slope factors are negatively correlated with carry trade excess returns." (1388)

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