Capital Markets Guide 2011

Capitalizing on Real-Time Data and New Risk Strategies for a Trading Advantage

by Sybase | an SAP Company

Capital Markets Guide 2011

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Capital markets firms are on the offense once again, and rightly so. But they must operate efficiently and responsibly.

■ **John S. Chen,** Chairman and CEO, Sybase, an SAP Company

Getting Back in the Game

The previous decade's financial crisis taught us that, despite the rhetoric, no bank is too big to fail. Size breeds complexity, making the largest financial institutions' operations impossible to understand, much less administer.

When Bank of America's assets reached $2.3 trillion—ten times more than Exxon Mobil—*The Economist* noted that managing such a huge portfolio may be "beyond the ken of mere mortals." Capital markets firms should return to playing offense, focusing on innovation and growth, but pursue these goals with the requisite competence.

A technology foundation is the best way to control the ever-growing amounts of data flowing within your firm's operations. Build state-of-the-art data mining and analytical tools on that foundation to answer the right questions, at the right time and for the right people—all in the right format.

That's easier said than done. *The Wall Street Journal* reported in March that "the financial sector has been constrained by banks' need to hoard capital" at record levels. This reduces the capital available for technology investments in an increasingly complex global business environment.

Still, institutions can learn to manage complexity. This book can guide you and your organization on the path toward effectiveness, enlightenment and profit. ■

ADVANCED TRADING

2011

CEP BREAKS OUT

2011

QUALITY REAL-TIME DATA

QUALITY REAL-TIME DATA

CHANGING LANDSCAPE

2011

MARKET RESEARCH

Where last year's guide covered the new regulatory environment, this year's guide covers the impact of real-time data and how to take advantage of new risk strategies.

The Capital Markets Guide 2011 provides thought leadership on how to capitalize on real-time data and leverage new risk strategies for a trading advantage.

■ **Steve Capelli,** President of Worldwide Field Operations, Sybase, an SAP Company

Pursuing Newer, Bigger Goals

The market is waking up to a huge world full of unprecedented opportunity in exciting new places. Firms have weathered a crisis and adapted to new regulations. Now it's time to get down to business.

Welcome to the *The Capital Markets Guide 2011.* The guide's mission is to provide you with cutting-edge thought leadership from some of the most knowledgeable people in capital markets.

Where last year's guide covered the new regulatory environment, this year's guide covers the impact of real-time data and how to take advantage of new risk strategies. Articles and research focus on technological innovation, business strategy and geographical markets. And just like last year, this publication is full of insights from Sybase experts and other leaders across the financial services industry.

Advanced Trading discusses the latest technology and legislation that surround trading. CEP Breaks Out explores the hot topic of complex event processing (CEP) and its future impact on global trading. New Risk Strategies strategically evaluates new ways to manage risk. Innovative approaches to help harness and analyze real-time data are presented in Quality Real-Time Data. And Changing Landscape examines how international markets are reinventing themselves. The guide closes with a rich set of market research that provides an interesting view of global financial indicators.

We hope the insight within this guide proves valuable to you as we all move forward into a world of real-time data and advanced trading. ■

Three rules for success
can provide a critical advantage
in the race to zero latency.

Winning the Race to Zero

Deutsche Börse Group, one of the world's leading financial exchanges, recently developed a new ultra-low-latency trading infrastructure linking Frankfurt to five other key worldwide trading centers. The target for the Frankfurt-London link was 5 milliseconds (0.005 seconds).

Pushing the limits of how quickly computers can process instructions is the new battleground in finance. True zero latency may be mathematically impossible, but as technology continually shatters the benchmarks of the past—moving transaction speeds from milliseconds to microseconds (millionths of a second) and even to nanoseconds (billionths of a second)—it is quickly closing the gap. Today, the industry average for a typical pre-trade risk check is about 125 microseconds (0.000125 seconds) and getting faster all the time.

You don't achieve such exponential performance breakthroughs by doing things the same way you

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always did. And yet, nobody in the financial services industry has the luxury of being able to rip and replace their mission-critical systems. Today's environment requires a new set of rules.

Rule 1: Build on your existing systems to minimize business disruptions.

Compromising existing applications or structural components may be the fastest route to a big step up in performance, but that approach is a nonstarter. The systems in use at today's firms

are well defined, secure and highly leveraged. Companies need an additive approach—one that will leverage their existing investments and prevent disruptions to the business while making it easy to introduce new components that will shave latency from transaction times.

Hardware and Software in Parallel. What companies can't do is rely solely on off-the-shelf products or routine data center upgrades to

achieve their performance objectives. Faster hardware arranged in an efficient, modular architecture will surely be part of every firm's "race to zero" strategy, but hardware alone can't do the job.

At its root, optimization is a software problem, but even the most advanced, highly parallelized processing engine is limited

> *The race to zero will be won by companies that are willing to harness the beauty and benefits of hardware and software simultaneously.*

by the hardware on which it is deployed. A system that can process 1 million messages per second is still operating at only 50 percent of its true potential if it isn't deployed on multi-core servers with distributed management. The race to zero will be won by companies that are willing to harness the beauty

When hardware and software are considered in unison, the sky is the limit.

and benefits of hardware and software simultaneously.

Rule 2: Use accelerative hardware and software in strategic combination.

Finance's new real-time requirements are fueling a cottage industry: boutique technology vendors intensely focused on addressing the ultra-low-latency problem through innovation. And, not surprisingly, they are doing this precisely by crossing the hardware-software chasm.

Solace Systems and 29 West (recently acquired by Informatica) are among the leaders in this boutique industry. These companies have embedded high-performing silicon-based optimization systems on very specialized hardware appliances designed to let the software operate with maximum speed and reliability. It is a specialist infrastructure intended to meet the specific high-performance requirements of capital markets firms. Despite being a relatively new technology, such trading appliances can deliver astonishing results in raw processing performance, which ultimately extends the boundaries of trading volumes.

These vendors are approaching the challenge much like a Formula One racing team. Naturally, the engine of an elite racing car must be designed for high performance, rapid acceleration and sustained high speeds. But these innovations cannot be fully realized if the auto chassis creates drag, or if the fuel grade or the tires are inferior. When the right choices are made on the outside, the engine is liberated from hurdles that would constrain its performance.

Similarly, when hardware and software are considered in unison, the sky is the limit.

High performance is its own reward, but companies must be able to achieve their ultra-low-latency goals without causing any disruption to the business (see **Rule 1**). That's

why valuable market innovations such as trading appliances conform to today's best practices for distributed platform architecture.

Rule 3: Adopt a next-generation platform architecture to harness complexity and minimize latency.

To achieve ultra-low latency without compromising existing systems, companies need a platform strategy that can achieve massive scale-out for data analytics and massive scale-up for extreme transactional environments. The Next Generation Information Platform (NGIP) is such a strategy. NGIP inherits from innovations across the data-centric set of IT components: Faster processors and a larger number of cores, larger memory,

faster interconnects and so forth all play a role in allowing applications to scale better.

Macro technology trends, such as memory-centric computing and cloud computing, are another

important facet of NGIP. By using the cloud, NGIP will satisfy a firm's growing demands for event-driven processing at lightning speeds. It also enables the flexibility to support whatever application- or data-tier innovations the firm elects to invest in.

Leading trading firms rely heavily on news and event data streams while also tracking trade history and price fluctuations. As a result, the volume of complex event data that automated trade

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systems must analyze is massive. The key to managing this data volume is to perform resource-intensive computations in firms' private cloud environments so

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that transactions and analytics occur quickly and efficiently. NGIP's cloud-centric approach means firms can obtain the computing power they need quickly and painlessly.

Using the cloud doesn't mean giving up control: With NGIP architecture, capital markets firms can invest in whichever technologies they choose to make their trading systems more efficient. NGIP facilitates a close affinity between hardware and software without eschewing the tremendous opportunity and cost-savings potential offered by the cloud.

Finally, NGIP adds value without upsetting existing IT functions. It works like a pipe inserted into an IT system, circumventing traditional bottlenecks and

allowing high-volume messages (beyond 1 million messages per second is the new standard for fund managers) to flow at near-zero latency—without disrupting downstream heritage systems.

Toward Zero Latency

Getting to near-zero latency isn't trivial, especially in light of today's aggressive requirements for collection, storage and analysis of complex data. But it isn't beyond reach, either. A flexible architecture that embraces hardware and software synergy without introducing business disruption is a trifecta that can push you to the front of the pack in the race to zero. ■

As a Sybase vice president and the company's chief technology officer, Irfan Kahn oversees all the technology offices in each of Sybase's business units. Together with the architects in these technology offices, he is chartered with ensuring that the voice of Sybase's customers and the needs of the market are reflected within the company's innovation and product development. In addition to his CTO responsibilities, he oversees technology evangelism efforts for Sybase.

When Data Becomes Kryptonite

Foreign exchanges need the mythic superman trader more than other exchanges do. Data volume and fluctuating market activity can create a blind spot—even for Clark Kent.

Everyone firmly believes his or her marketplace is unique, but the foreign exchange (FX) market is truly like no other. It is a pure counterparty market, with no real "exchange." Sometimes even the winners lose (on margins), specifically when they cannot easily view all the market data available and make fact-based pricing and ordering decisions.

What else makes the FX unique? Sheer volume. During the past decade, the daily volume of FX has almost doubled—from $1.7 trillion in 2000 to more than $4 trillion in 2010, according to the Bank for International Settlements' Triennial Central Bank Study in April 2010 on global FX market activity. This market is incredibly active when compared to the Nasdaq Stock Market (Nasdaq) or the New York Stock Exchange (NYSE). The average daily volume in February 2011 on the Nasdaq or the NYSE was between $100 and $120 billion, while the average daily volume on the FX was $4 trillion.

The FX market moves fast. As many as 100 market-making bank participants stream thousands of market quotes per second. With

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Chief Executive Officer,
TraderTools

that kind of volume, the amount of data available is massive and overwhelming. Capturing the best execution, even for the most skilled traders with superhero skills, is almost an impossibility.

From Manual to Electronic

Only three years ago, the majority of business was handled manually, as the FX transitioned to electronic orders and purchases more slowly than the equities or fixed income exchanges. By 2010, electronic orders were predominate, and they are expected to continue to increase each year.

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The multiple streams of data in the FX market increase the need for traders to understand if they are looking at their currency exposure from all sources of supply and demand simultaneously. They also need to see the data in real time and electronically. The volume of trades in the FX market is too high and, with ballooning

FX Trading Activity in 2010

Activity	Percent
Voice	15.9%
Interdealer direct	18.5%
Customer direct	24.3%
Electronic trades	41.3%
Electronic Trade Breakdowns*	**Percent**
Single bank white label	11.4%
Multibank, aggregation or ECN	11.1%
Broker systems	18.8%

*Based on the 41.3% of electronic trades
Source: Bank for International Settlements'
Triennial Central Bank Study, April 2010

tickets, executing trades manually is ridiculously outdated. To succeed in the FX market, firms must be able to quickly and easily aggregate market data, define best pricing, handle the order management and execute the order.

Typically, firms rely on single-focus solutions that take a silo approach and solve only one of their FX challenges. Firms might select a white-labeling system or an electronic order management platform, but few can view the FX market with a comprehensive integrated system that takes a real-time picture of the market, manages orders against that real-time picture, executes orders against conditions or triggers and understands—from the current inventory—if the trade makes the bank long or short. The FX trading cycle is continuous, and any institution that doesn't integrate those four steps is essentially giving up alpha, margin or both.

Aggregation. Traders can aggregate data in different ways. Maybe they visually track multiple computer screens, or the organization relies on a white-labeling option from a bank. Both scenarios have disadvantages. If traders miss information because they can't aggregate all the data, they give up best pricing. Electronic communication networks (ECNs), on the other hand, give up relationship pricing, and FX is relationship pricing focused.

Market conditions and a general return to more relationship-based trading has emphasized the need for more bespoke aggregation services that reflect a firm's many relationships. Prior to the financial crisis, large prime brokers were giving away their services to get market share.

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The focus was on order flow, and it did not matter whether they made money. Now credit costs money, and banks are returning to traditional counterparty relationships. Consequently, more emphasis is on relationship-based pricing and less use of anonymous trading.

Traders need to be able to capture significant trading statistics so that they can get the best price offers from liquidity providers. This intelligence ensures that they always get the most liquidity at the best prices available. The better the information exchange, the better the relationship, and better pricing leads to more profit for both parties.

Pricing engine. A typical firm accepts thousands of orders in a day and executes only a small percentage of them. A pricing engine processes the full depth of the market to constantly and consistently find the best bid and offer, subject to powerful rate-staleness and validity filters. Rates can be streamed through a spread engine, which applies spreads based on a predetermined set of rules. The rules enable the setup of different spreads to different customers, based on currency pair, quantity, customer credit profile or any combination.

White labeling. Price delivery in a custom envelope helps tie customers to a firm. The more effective distribution strategies in FX trading all revolve around more effective pricing. Essentially, firms have three ways to distribute prices to a bank's customers: an FX white-labeling solution, which most institutions have adopted and are looking to upgrade; a multibank portal; and a Financial Information eXchange (FIX) application programming interface (API) to the customer.

The method a bank chooses depends on its size and

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customer base; however, regardless of the channel, it must ask whether it is making the best possible prices and offering razor-sharp prices for different customer profiles.

Order management. Managing conditional orders from customers has always been a challenge. The advent of high-frequency trading models and algorithms makes the process that much more difficult. During the last 18 months, the marketplace has seen a slight readjustment. Customers are returning to smaller banks due to the lack of availability of "subsidized" prime broking and similar promotional offers from top banks. The smaller banks are challenged to provide these returning clients with the same level of functionality offered by the big banks, such as a range of order types and the ability to execute complex order types. Banks must enable clients to engage in a sophisticated synthetic cross, and the banks need to be sure that both legs of the cross have matched and were executed or cross the trade only when both sides are suitably priced.

FX Decisions

Both sell- and buy-side firms realize that an integrated FX trading platform is in their future. More advanced complex event processing (CEP) technology is making the decision to license off-the-shelf platforms a more viable option than using a hosted ECN solution or building it internally. The market winner will be determined by who has the best technology to make the fastest and most profitable trades. ■

Before co-founding TraderTools, Yaacov Heidingsfeld established and operated a hedge fund specializing in FX, interest rate and index option trading. Previously, he was a trader at Oscar Gruss and IDB in Tel Aviv and at Standard & Poor's in New York. He holds a B.A. in business and finance from Baruch College, New York.

HFT Prompts Regulation Scrutiny

Will increased regulation lead to the end of high-frequency trading as we know it?

High-frequency trading (HFT) drives as much as 77 percent of U.K. equity market exchange trading, according to a Tabb Group estimate from January. Having been involved in running an exchange, I say this claim exaggerates the level of HFT activity and pours fuel on the anti-HFT fire that already burns bright.

Determining such a figure is difficult. Some HFT flow is indirectly routed to the market by HFT firms using their prime brokers.

In my experience, direct exchange-traded HFT in the major European markets accounts for about 40 percent of equity market exchange trading. Another 10 percent is agency brokerage of largely institutional business, and the remaining 50 percent comes from investment banks, including HFT. HFT flow probably accounts for around 60 percent of overall activity.

Even HFT firms acknowledge that a flow mixture is crucial to efficient interaction.

Register HFT Firms as Market Makers?
Accusations, right or wrong, followed the May 6, 2010,

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"Flash Crash," and critics charged that HFT liquidity providers should pull out when the going gets tough. Now the European Commission (EC) could mandate that HFT liquidity providers continue providing liquidity in both good and bad times.

How would this be implemented? Would all firms that utilize liquidity provision algorithms need to register as official market makers?

Even passive institutional buy-side and sell algorithms can post liquidity in practice, but

it would be wrong to classify those as market-making algorithms. This also holds true for most HFT strategies.

Firms should become market makers if it fits their business model, as did Getco in February 2010. However, registering firms as market makers does not provide absolute security. Flash Crash evidence shows that even registered market makers pulled back. Companies pulled back in the days of floor trading, too. The EC has suggested that trading venues monitor such activity and determine when it warrants being categorized as market making.

Allow Liquidity Detection Techniques?

Some HFT strategies employ liquidity detection techniques, which inform trading decisions by seeking larger institutional orders sitting in exchange order books. Buy-side firms suggest that these techniques lead to adverse market impact.

There are also adequate techniques that counteract such strategies, slicing and dicing an order, and then representing it in multiple pools, both lit and dark.

Firms often link strategies across a range of asset classes, so that they need very short exposure time when providing liquidity.

Is Quote Stuffing Detrimental?

Although the root cause of the Flash Crash was a long-only investor, opponents of HFT alleged that such activity exacerbated the market falls. Computer algorithms used quote stuffing to gain an edge during the crash, according to a study by Nanex, a trade database developer.

HFT firms would use quote stuffing to flood the marketplace with bogus orders that distract rival trading firms. Investors might make trades based on those orders, only to see them canceled. Liquidity disappears, and the market moves against those investors.

Other experts believe that deliberate market manipulation is unlikely because HFT firms could not profit from such orders in any practical way. These orders more likely are designed to test latency times and to detect early price trends.

In September 2010, regulators probing the crash concluded that "quote-stuffing—placing and then almost immediately canceling large numbers of rapid-fire orders to buy or sell stocks—was not a 'major factor' in the turmoil."

Implement Time Requirements?

Some observers theorized that HFT could have

In modern day electronic trading, 50 milliseconds is an eternity.

helped minimize and reverse the Flash Crash, given that the market rebounded on the back of HFT systems almost as fast as it fell.

This observation calls into question Flash Crash conclusions made by Nanex. The company's first suggestion is valid; that is, exchanges must stamp quote and trade data at the time it is generated. This will ensure that everyone can detect delays.

The second suggestion, that quote stuffing should be banned, is good in principle but is less plausible. It is difficult to define what constitutes quote stuffing. Firms often link strategies across a range of asset classes, so that they need very short exposure time when providing liquidity. This approach allows firms to react to news and general market movements.

For this reason, the third suggestion, a 50 millisecond quote expiration rule, is also unworkable. A quote would remain active for at least 50 milliseconds or until it is executed. Fair enough, but that quote may be improved (higher bid or lower offer price) at any time without waiting for the expiration period if it is part of the National Best Bid and Offer (NBBO).

The EC is also looking for the power to define tick sizes and impose a minimum resting period for orders before they can be cancelled. Or the EC might implement a cancelation ratio

threshold that participants may not exceed.

Such practices may work where markets behave rationally. But markets are more complex, behaving irrationally based on human behavior.

This EC approach increases risks by holding back quote updates when needed. Faster quote updates from liquidity providers tighten spreads and increase depth. That aids price discovery as the liquidity takers have the opportunity to trade more times on a faster system—with potential price improvement. This benefits market participants as a whole, from fundamental investors to short-term quantitative players.

Additionally, the world's top systems currently trade faster than 50 microseconds. In modern day electronic trading, 50 milliseconds is an eternity.

Register Algorithms?

The EC wants all firms engaged in automated trading to implement robust risk controls and register their algorithms. It is debatable whether this measure can prevent rogue algorithms.

Moreover, it is very difficult to implement because algorithms change frequently according to market conditions. The sheer volume of work this would generate could render the process unworkable.

Finally, not making changes to trading algorithms in a timely manner may create market inefficiency. India, where exchanges must approve all changes, suggests that this requirement merely becomes a tick-the-box exercise as those approving the strategies have no real understanding of how they work.

The best way to police rogue algorithms is to have controls at the trading venue level. Such controls would largely exist as preventive measures, but would require some consistency across trading venues.

The Technology Factor

HFT has been good for the market by narrowing spreads and providing liquidity where the appetite for traditional market making has waned. Quick reaction to information is important because most HFTs have differing strategies, apart from latency arbitrage, but do not want to be latency arbitraged themselves.

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"Some market participants have also raised concerns that they are at a disadvantage to HFT as they are not able to make similar investments in trading technology," the EC reported. But trading firms employing HFT techniques are competitive through their technological edge. Trading networks, like motorways, are available to a range of users, from the private client to the institutional fund manager. Given that technology today is more accessible than ever before, both financially and physically, it is rather the case that not all firms want them—or require them.

Clearly, regulators should also adopt such technology to keep pace with innovation, avoiding a multibillion-dollar supervisory function on market data in response to the Flash Crash. The hope is that future regulation will not curtail innovation, but foster opportunity, keeping markets honest and efficient as new technology brings light to markets. ■

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High Volume, Low Anxiety

New technologies emerge to combat the data onslaught from high trade volume.

In the time that it takes you to read this sentence, approximately 10,000 equity orders and quotes will be sent to the main European equity venues. Approximately 75 percent of those messages, according to the *Financial Times*, will be high-frequency trades: short-term positions held for a period of milliseconds or, at most, seconds, and every one of them automatically generated and tracked by a computer program.

This trend is not slowing. By some estimates, the overall volume growth of these types of trades has reached 50 percent year over year. With numbers like these, it is clear that the stock market of the future is, by and large, a world of automation. Increasingly, the role of humans will be relegated to the inception, oversight and optimization of the programs that generate and execute these transactions.

For those prone to Orwellian paranoia, fear not: Organizations that survive the transition will enjoy more opportunities to increase revenue with lower risk. But to get there, financial services organizations will need to spend the next several years investing in real-time monitoring and risk control systems that can handle the analysis of such high-volume data.

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Upgrading for Speed and High Volume

Today, the pressure is on companies to track, analyze and derive usable intelligence from the vast information flow that high-frequency trading leaves in its wake. To do that, they must act quickly to upgrade their technology infrastructure and analytical systems. These upgrades primarily fall into three categories:

- Larger and faster hardware that can perform the necessary analysis with low latency, allowing trading signals to be generated back into the order execution platforms

- Larger storage arrays to maintain the tremendous volume of trading history that high-frequency trading creates and also relies upon for the back testing of new strategies
- Novel software systems capable of real-time risk control and compliance monitoring

Upgrading processing power and storage capacity are critical to the equation, but these endeavors are straightforward enough. Risk control and compliance, on the other hand, require a willingness to challenge the status quo and reevaluate the way the company handles data monitoring from the ground up. Resistance to change and associated cultural entrenchment are typical at this level of transformation. Fortunately, the size of the opportunity will prevent most firms from such distractions.

This new breed of technology is appropriately coined complex event processing (CEP), as it aggregates vast stores of data and uses many complex events as a source of best-possible guidance toward revenue optimization and risk reduction. It won't be long before CEP is found everywhere in the financial

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services industry and beyond. In five years' time, the way that capital markets firms manage risk will look nothing like it does today, and high-frequency trading will have been a primary factor in the transformation.

Managing Risk through Complex Events

The development of new high-frequency trading strategies takes time, and yet the shelf life for these strategies can be very short—weeks or even days. The strategies must be continually optimized, and the best way of accomplishing that is to provide automation: a platform that enables those strategies to be added, updated and switched in or out according to market conditions. By making it easy to develop new and improved trading algorithms and providing a robust historical model against which to back test them, CEP helps quants—the men and women who develop trading algorithms—be more effective and productive.

It isn't just quants who benefit. What CEP really provides is a single, comprehensive and up-to-date view of the truth, delivered precisely when it's needed. By aggregating data from multiple sources—for example, merging the latest market risk and credit risk views with the latest movements of the

market—CEP provides much better insight into trading activity as it happens.

Critical characteristics of CEP include the following:

- The application of complex, sophisticated logic to disparate streams of data
- The capability to process extreme data flow volumes in real time
- Support for the rapid deployment and evolution of new applications without involving back-office personnel
- Low latency for every tick that traverses the system

Putting on the Brakes

Not surprisingly, the sheer volume of automated trades has not gone unnoticed by regulators. Regulators in the U.S. found that high-frequency trading exacerbated last year's Flash Crash, but regulators stopped short of fingering high-frequency trading as the primary cause. In Europe there is talk of an effort to suppress a percentage of high-frequency trading.

Such rumblings are unlikely to result in actions that would significantly alter the current trajectory; however, if more stringent regulations are indeed on the way, the role of CEP in the future of the financial services industry will only get bigger. CEP is ideally positioned to allow both trading firms and the exchanges to rapidly comply with those regulations.

Regardless of what regulators may decide about high-frequency trading, there's no doubt that CEP is the right choice to lower risk in our high-volume world. ■

Nick Deacon has been working on risk and front-office-related projects across a number of tier one firms within the capital markets sector over the last 18 years. Prior to joining Sybase, he held various roles at the CEP startup and pioneer Aleri, including EMEA sales, the oversight of all aspects of Aleri CEP technology development as well as implementation and education services. Previously, Deacon was the managing director of international operations at Flexi International.

CCR Management Shake-Up

New rules and laws around counterparty credit risk could make it more difficult to manage risk. Make sure you're prepared.

Over-the-counter (OTC) derivatives contracts present risk exposure from several different sources, including counterparty credit risk (CCR), which embodies the risk of the counterparty defaulting on a future payment.

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CCR is not traditional credit risk associated with lending. CCR results from the natural uncertainty of future exposure to an OTC contract. It also includes mitigating these complexities through techniques such as collateral posting, netting and hedging with credit default swaps.

But firms must quantify risk before mitigating it. Accounting requirement FASB 157 identifies the market value of this risk (the credit valuation adjustment, or CVA) and reflects it in the book value of the contracts.

One way that banks control their exposure to CCR is to price CVA into a trade, rather than the typical practice of relying on position limits. This process may be the more accurate way to manage counterparty exposure.

Calculating CVA requires complex simulations to determine how market behavior is likely to affect counterparty exposure. Moreover, a firm holding positions with a counterparty would still influence the CVA of an incremental trade.

A trade that offsets risk on currently held positions should reduce CCR, whether the offset was in part or in full, and it should be reflected in the calculated CVA.

New Regulation and Legislation on CCR

The Basel III Accords and the Dodd-Frank Act both address

Banks can reduce their exposure by more aggressively employing hedging strategies or favoring derivative trades that will be acceptable to CCPs.

CCR, but in different ways. Basel III sees CCR as a matter for the firm to manage. Dodd-Frank attempts to reduce CCR, at least for the banks. It requires that a central clearing counterparty (CCP) pass all OTC derivatives through, transferring CCR out of the bank. The CCP stands between the trading parties. In effect, it facilitates the transference of risk from a bank to itself.

Basel III rules fill the inherent gaps of the Basel II Accords' stance on counterparty risk. Basel II incorporates the likelihood of counterparty default. But it does not address what happens when widening counterparty credit spreads generate mark-to-market losses. Moreover, Basel III explicitly recognizes that a correlation between systemic risk and the assets of financial firms existed during the financial crisis. It requires that correlations used in calculating risk assets be adjusted accordingly.

These and other adjustments in the calculation of counterparty exposure substantially increase the amount of regulatory capital that

banks will be required to hold for a given risk-weighted asset mix. The regulations will create incentives for banks to better manage and attempt to reduce their counterparty exposures.

Banks can reduce their exposure by more aggressively employing hedging strategies or favoring derivative trades that will be acceptable to CCPs. In this regard, Basel III encourages behavior that is consistent with the stated objectives in Dodd-Frank: move as much derivative trading to CCPs as possible.

Plan Ahead, as Pitfalls Are Many

Actual implementation requirements are not mandated

for several years. But incorporating CVA in pricing decisions as well as in value at risk (VAR) calculations is a sensible step toward more effective risk management and risk taking.

The ultimate objective would be CVA desks pricing out counterparty trades in tandem with trading desks focusing on the price of a trade reflective of market conditions. But the difficulty is in the details.

The sheer quantity of calculations that would need to be performed quickly to prevent measurably slowing down the trading process is impressive to say the least. Moreover, data management issues in attempting to accurately reflect how the incremental position with a counterparty influences the firm's overall risk exposure also poses some very significant problems.

These two challenges— among several serious operational problems— will make building effective CVA desks difficult for all market participants.

> *IT-related issues may differentiate an institution's ability to properly calculate CVA.*

IT-related issues may differentiate an institution's ability to properly calculate CVA. Those same issues could prevent a firm from incorporating CVA into its pricing for trades. As a result, the firm may not be able to properly and efficiently manage its overall risk exposure—and consequently its regulatory capital requirements. This lack of visibility could have a meaningful impact on an institution's cost of business and competitive position.

These and other pitfalls illustrate why affected banks would be wise to not wait for regulatory deadlines to begin investing in the necessary infrastructure to comply with Basel III. ∎

Ben Wolkowitz is a senior adviser to Headstrong in New York. He advises on domain-related activities drawing on a background in fixed income markets, compliance and finance developed over a career that included working for the Federal Reserve, teaching at the university level and hands-on Wall Street experience. He has written extensively on financial markets and regulatory issues.

Behavior Modification

Reengineer human and systems processes using systematic approaches with available technologies to get best results.

Beginning with the wheel, human evolution is, arguably, the story of inventing and exploiting new technologies. From Edison's light bulb and Bell's telephone to multi-core processors linked by fiber-optic cabling, the challenge in trading has been to keep up, adapt, adopt and exploit.

Justyn Trenner
CEO and Principal,
ClientKnowledge

While trading has moved from floors to electronic matching processes, many market participants have been slow to derive the potential benefits of these changes. However, by exploiting the right technology, institutions can increase the profitability of existing flows while reducing risk and servicing costs.

The Value of Trades

It has never been a simple feat to measure accurately the value of trades. For a sell-side institution, the first challenge is the appropriate mark-to-market against which the captured trade should first be valued: Is it the price shown at the top of the book at the time the price was made or at the time the order was accepted or finally when it was filled? Or should the mark be the price at which the trader managing the book was willing to quote? And if this last, who should bear the risk of slippage (or gain) between the time when the price was made and the order was filled? Having sorted that, how should incremental value to the trading book of accepting this trade be accurately measured (irrespective of to whom that value is ultimately ascribed)?

When thousands of trades are flowing through a bank's pipes and the markets are moving at multiple updated prices per second, applying any of these marks-to-market is challenging enough. Without a systematic approach to benchmarking trades—without a data processing, analysis, reporting and storage

*It has never been
a simple feat
to measure accurately
the value of trades.*

system devised to cope with such challenges—the task is, literally, impossible. Hence, institutions need to put in place a real-time system that is fit for the purpose.

Fixing choices and then determining the calculated answers to these questions will lead to revelations that inevitably will be disruptive and politically charged. Revenues that are already profitable are frequently revealed to be less profitable than they could be. Effective benchmarking will prove the value added by some teams and processes, but it also will reveal the limitations of others. The manager who introduces a project that promises such discoveries may end up the hero, but can expect significant resistance from those fearful (often wrongly) of the outcome.

Measuring Value
But without reliable answers, no institution can be certain

that it knows which clients, instruments and traders add value and which impair value. Worse, without a real-time process, ascertaining risk across the institution at any given moment is impossible. Once in place, the same processes will allow the institution to measure accurately how much value is lost (or, in theory, gained— but it never is!) by slow pricing, capture of trades and risk management of positions.

One benefit from building and applying this approach is reduced risk—particularly hidden risk, held in processes awaiting reporting to a central book and, therefore, unmanaged and unable to be offset against counterpositions or managed at the earliest opportunity. Another benefit is increased income through more reliable capture of mark-to-market profit and markup on client flows (precisely because the positions will be both recognized and bench-marked earlier and more accurately). Moreover, because real-time reporting will show client trades received at a mark-to-market loss, the bank will be able to move promptly to reassess pricing to given clients, eliminating unintended losses and/or improving margins.

All of this should be allied to reduced costs. The first cost elimination is usually evidenced in error reduction in the processing of trades, since unexpected trade outcomes can be alerted in real time and thus the source of the error more readily found. Thereafter, cleaner trades make for more efficient end-to-end handling processes, requiring less human intervention in trading and in middle- and back-office functions.

Delivering Benchmarks

Today, the key ingredients for delivering these benchmarks are readily available: fast computers and networks, fast databases and real-time data management tools—effective, designed-for-purpose, real-time tools that include complex event processing software allied to appropriate databases and visualization tools. The impediments to putting in place the required processes and systems fall into two distinct camps—the inevitable challenges to working practices, and the inevitable challenges to trade workflow. Working practices and trade workflows bring together the processes by which price quotes are determined and then shown to clients, the capture of trades, the reporting of trades to the
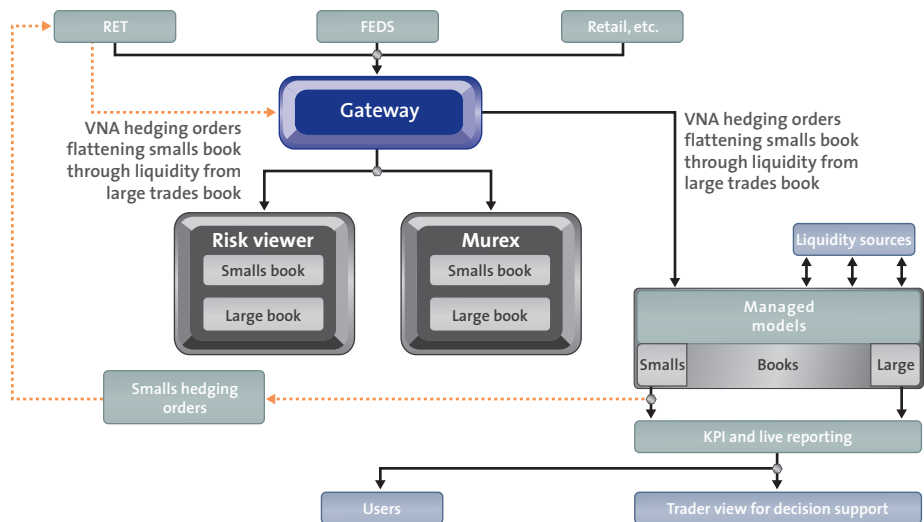
Source: ClientKnowledge

Architecture for a Systematic Approach: This typical architecture can help institutions deploy a systematic approach to trade capture, real-time benchmarking and market risk management.

The only way to create consensus around these changes is to allow the numbers to do the talking.

risk traders and to accounting and settlement, and the middle- and back-office functions.

Inevitably, changing human behaviors and the systems with which those people constantly interact implies changes in the daily working routines of valued staff, the revaluing and possible reassignment of some staff and making more transparent the points in the process where value is added and lost. The only way to create consensus around these changes is to allow the numbers to do the talking. Therefore, the key first step is building a real-time benchmarking process that includes data capture, marks-to-market and data analysis.

In terms of trade workflow, the likely impact of regulation will be the accentuation of the need to maintain credible open measures of trades, margins

and risk. At the same time, the push toward electronic reporting of trades—and, across more and more markets, to clearing those trades— is likely to compress the margins available to sell-side institutions. Therefore, the only way to continue to extract profit with reduced margins and managed risk must be to learn to exploit the available technologies more effectively and work hard and intelligently to reengineer human and systems processes. ■

Justyn Trenner has led ClientKnowledge since its inception in 1993 and has used innovative technology and mechanisms to help banks and other trading firms maximize the value of their franchise. He consults to top-tier and regional banks to develop the framework to address their strategic challenges and deliver against their goals. He also provides consulting on detailed tactical change, which led to the expansion of ClientKnowledge into the algorithmic field with its division Managed Models.

Complex event processing divides the
haves (firms that most efficiently reap the benefits of
real-time data) and the have-nots (firms that can't).

The CEP Line in the Sand

Data determines which side you're on. A line in the sand divides the market between the haves (firms trading with confidence based on an integrated and deep real-time understanding of their combined internal information and the market) and the have-nots (those whose systems are still largely based on a fragmented and inefficient understanding of internal information and market data).

It's all about data and how you use it.

The volume of data is increasing, and pressures are mounting on systems across the front, middle and back office. Firms realize they need to use technology that aggregates and analyzes data from scattered systems. The results inform a variety of users about trends and patterns—in as near to real time as possible.

The implications are huge. Many facets of this fiercely competitive global marketplace demand real-time, or intraday agility. A delayed response to changing conditions or the inability to prevent an

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Financial Services Business
Development Manager,
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unwanted action can be costly. Hence the pressing need for a low-latency, event-driven solution that can distill insight from floods of information.

Increasing Obsolescence of In-House Development

Historically this need would have been met by bespoke in-house development. In certain cases that method is still relevant.

However, two trends emerged as firms posted positive fundamentals in 2009 by removing cost, largely from their operational environment. First, increased revenue drives improved financial results, not heavy cost cutting, as proven in 2010 and more so in 2011.

Second, many firms now lack support for in-house developments because of a loss of operational capacity, such as a diminished capacity to support development team output. These firms seek an easily supported, standards-based solution that enables rapid deployment of services to meet new business requirements.

That solution is called complex event processing (CEP).

CEP enables firms to quickly deploy new services based on aggregated streams of multifrequency data—without needing extensive development resources.

What CEP Brings to the Table

CEP enables firms to quickly deploy new services based on aggregated streams of multi-frequency data—without needing extensive development resources. The technology ensures confidence in the final results, because business

Firms using CEP can profitably engage in improving trading analysis, execution and monitoring.

teams can see their models in the development phase and fix errors otherwise lost in translation.

The CEP engine can react to events in real time, monitoring and notifying multiple functions from one place. This capability enables the start of an integrated and cyclical process whereby the middle and back office can react quickly to front-office activities—and can even become a service to the front office.

Front-office technology employs low latency, data integration, event processing and analysis to help enterprises make sense of the data streaming through their networks—or hidden in a previously inaccessible environment. Firms using CEP can profitably engage in improving trading analysis, execution and monitoring.
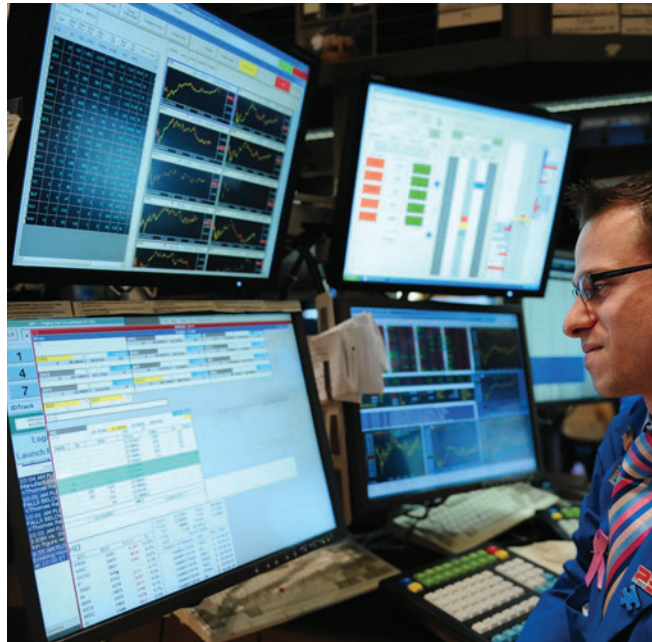
Firms not using CEP will drift to the sidelines.

Middle-office firms can integrate disparate data from multiple sources into one place. This capability pulls together data and analysis from a variety of current systems to give chief risk officers (CROs) a holistic view across all risk disciplines, lines of business and geographies.

Much of the data required for some practices remains the same, even if the analysis is different. So other CEP advantages include enabling real-time or on-demand limits assessment, liquidity management and capital allocation.

The line in the sand becomes a rift.

Firms standing on the CEP side will have the capabilities, connectivity and visibility to truly maximize their trading techniques and risk analysis.

Growing Popularity

CEP's capabilities have moved it beyond the realm of niche technology. Now, more and more securities and investments firms implement it in their front- and mid-office applications.

Mitsubishi UFJ Securities International incorporated CEP into its state-of-the-art trading infrastructure. The technology helps the London-based firm's traders get updates immediately, rather than in minutes. CEP also enabled Mitsubishi to double the number of currencies it tracks, giving traders a richer view into market opportunities without needing to add more expensive storage.

The technology is also versatile, which helps to solve many problems. Since different applications have diverse needs, some CEP platforms address

the widest possible variety of event processing requirements. These might include consolidating data from multiple heterogeneous systems into a single aggregate stream; operating large data sets spanning large time windows; and collecting raw data for historical analysis.

CEP automates cash and liquidity management processes so Barclays Capital, for example, can better monitor and forecast intraday positions across multiple payment and settlement systems using real-time data. And the Turkish Derivatives Exchange uses CEP to quickly detect abusive trading patterns.

CEP's mission is to make all types of available data— across each layer of a firm's IT

The rift between the haves and have-nots continues to expand needlessly, given how easy and economical CEP implementation can be.

system—comprehensible in relation to business goals and actionable in real time. CEP is neither complicated nor expensive to implement, although its name may suggest otherwise. Off-the-shelf technology easily plugs into other applications.

This simplicity makes it relatively easy to link many data sources inside a firm and query data in real time. Mitsubishi, for instance, rolled out its CEP-based infrastructure in a matter of a few weeks.

Still, the rift between the haves and have-nots continues to expand needlessly, given how easy and economical CEP implementation can be.

Where Do You Stand?
CEP's line in the sand is almost like a class divider.

Firms standing on the CEP side will have the capabilities, connectivity and visibility to truly maximize their trading techniques and risk analysis. They will reap the benefits of the 21st-century market.

And then you've got the rest, inefficiently trading with fragmented data. ■

Stuart Grant has more than 10 years' experience within the market data industry, working in product management and business development to provide market data and data feed solutions to buy-side and sell-side organizations to support the business-critical investment process, including quantitative, risk and performance analytics. Having recently joined Sybase from Thomson Reuters, Grant focuses on enabling firms to create a holistic trade data management platform.

The Right Tool for an Always-On Market

Analysis technology matures and improves to provide maximum benefit for trading firms that face new regulations and market pressures.

Complex event processing (CEP) has entered a new phase in its development. This technology aggregates information from distributed systems in real time and informs users of emerging trends and patterns. An increasing number of trading groups have adopted CEP in both front-office and mid-office applications, and the largest software providers now offer it. Here's why.

E. Paul Rowady, Jr.
Senior Analyst,
TABB Group

Integration Fuels Adoption

CEP technology has matured beyond software startup companies packaging it as a simple, stand-alone tool. CEP has become an integrated component of the next-generation data management stack, representing new levels of functionality, reliability and efficiency.

The strong new emphasis on delivering CEP as part of an integrated technology stack recognizes that CEP is rarely, if ever, deployed on its own. Modern market data and other critical data sources flow through in-memory CEP processes directly into long-term storage containers. And they do so without interrupting performance-intensive production routines and without the end-of-day reload. CEP and some high-capacity data stores have become complementary in this way.

CEP boasts new levels of reliability, flexibility and ease of use, which are among the leading requirements for any state-of-the-art trading platform. The technology also enjoys high levels of utility and the potential to solve a broad array of problems.

Focus on Risk Measurement

The world has catapulted trading firms into a new era of risk management that

CEP has become an integrated component of the next-generation data management stack, representing new levels of functionality, reliability and efficiency.

calls for accurate and timely information on their exposures, activities and processes—by volition or mandate. To manage risk under today's guidelines, firms face the challenge of how to consolidate and analyze information in a way that delivers sufficiently timely insight. The era of relying on overnight reports is in the past.

The goal of real-time risk measurement is deeper than mere continuous computation. The goal of real-time risk measurement is to continuously consolidate, normalize and aggregate data across many

disparate systems without needing to rework or replace those systems.

Analyzing Massive Quantities of Data
However, new regulations have come at a time when firms are dismantling isolated business silos and enhancing interconnectivity between business units. This shift results in a flood of data that companies must analyze. That data—and the specifications of that analysis—can overwhelm existing tools and methods.

Trading firms face an expanding need for real-time analytics—or as close to real-time analysis as possible. Risk measurement, as well as compliance, surveillance, market, credit and operational analysis, will benefit from real-time analytics.

CEP's functionality and analytics make it an important component of both enterprise applications and strategic data infrastructure.

CEP is an increasingly popular choice for both enterprise applications and as a core component of strategic data infrastructure. Its popularity is largely due to the unique fit between attributes of the problems and benefits of the new generation of CEP functionality.

as well as from internal business units and other sources.

Time is not on anyone's side because of the rigor of internal needs and regulatory reporting requirements. Trading firms need

> *The era of relying on overnight reports is in the past. Risk measurement, as well as compliance, surveillance, market, credit and operational analysis, will benefit from real-time analytics.*

to cultivate a vision that requires constant information from and about the collective intellect. A large part of this vision requires speed and capacity; doing more, faster and easier.

Trading firms cannot afford to have information about counterparty risks languish in data warehouses for weeks or months. Trading firms

The Always-On World
Today's world is an everywhere, anytime, always-on world. Trading firms must work more intensely than ever to harvest actionable intelligence out of a flood of data coming from an increasingly multiasset, multiregional sense of global markets—

The goal of real-time risk measurement is to continuously consolidate, normalize and aggregate data across many systems without reworking or replacing those systems.

cannot settle for anything less than timely and holistic assessments of all key risk metrics and all critical business activities, available wherever and whenever.

CEP was born out of demand for more active database functionality. It grew commercially as a stand-alone tool and then returned to be tightly integrated with the latest generation of data management solutions. Now that CEP has matured and returned home, technically speaking, there is no telling how far it can go in the capital markets. It is plausible that we are closer to the beginning of the story than the end. There could come a day when no data source will wind its way into a long-term data store without first passing through a CEP engine. ■

E. Paul Rowady, Jr. , a senior analyst at TABB Group since 2009, has more than 20 years of capital markets, proprietary trading and hedge fund experience with a background in research, risk management, trading technology, software development and hedge fund operations. He also has specific expertise in derivatives, highly automated trading systems and enterprise data management initiatives. At TABB he wrote Global Markets on Demand: Unified Infrastructure Required *among many other works. He earned a Master of Management degree from the J. L. Kellogg Graduate School of Management at Northwestern University and a B.S. in business administration from Valparaiso University.*

Regulation as the Mother of Invention

New laws and regulations will be the catalyst for the next generation of capital markets innovation.

The Basel III Accord and the Dodd-Frank Act bring increased capital requirements that will squeeze operating margins, along with disclosure requirements that will increase reporting costs. Capital markets firms must quickly innovate to improve information quality and lower the cost of capturing and aggregating data at all points along the trade processing life cycle, so that they can remain profitable and compliant in this new regulatory environment.

Dimensions of the Challenge

Internal development and acquisitions have added business functionality to capital markets firms throughout the years. Each business and operational unit is likely to have different data models tuned to the needs of the business.

The current regulatory situation poses great challenges for investment banks, asset and investment managers and hedge funds as they quickly move to comply and stay competitive. Two key dimensions to the challenge are the following:

- **Inconsistent representation of client, counterparty and legal entity hierarchies:** From client on-boarding, to credit, to sales and trading, to

Nancy Turbé
Risk and Regulatory Practice Lead, Accenture

risk and regulatory compliance, to finance, there is a critical need to understand who is doing what business and with whom. Capital markets organizations have complex legal entity structures, domestic and cross-border— as do their clients and market counterparts. A firm must fully understand and report on these structures to optimize capital requirements, comply with regulatory lending limits, manage exposure and assess trading opportunities.

- **Aggregated reporting and analysis requires increased data consistency:** Many firms have addressed
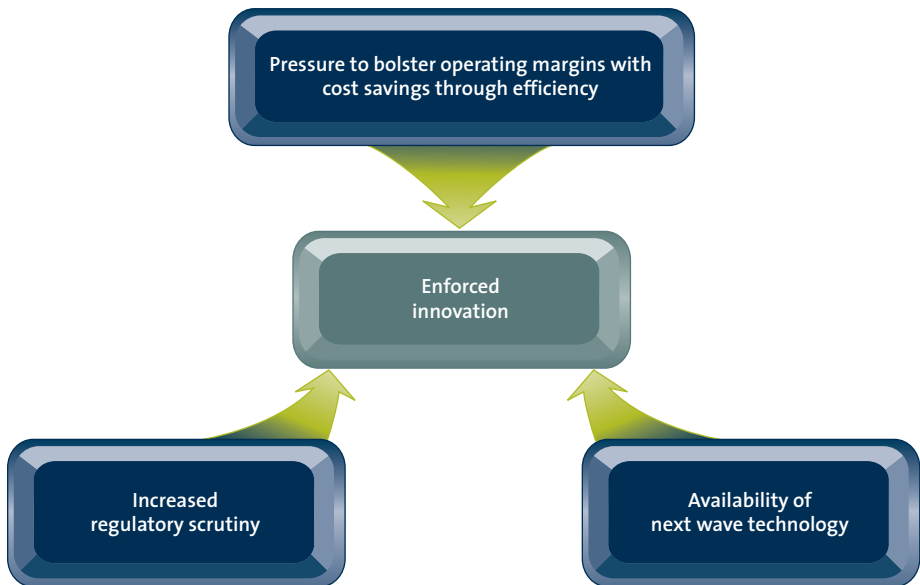
Enforced Innovation: *Several factors influence information architecture innovation in capital markets firms.*

only transactional data consistency in point-to-point data feeds between systems. They capture the data contract between source and destination solely in that feed, not in any mapping to a firm-wide model. Just look at feeds from the trading desk (trades and risk information) to operations systems (compliance, enterprise risk, operations). Compounding this problem, operational data stores are most often the result of custom development or a vendor representation or both. A firm may have hundreds of point-to-point feeds and several dozen different operational data stores. Each will often employ different data models.

Requirement to Innovate: The Ideal and Near-Term Reality

The ideal target for a capital markets firm is a next-generation information architecture: a set of services underpinned by a consistent information model, with standardized workflows from front
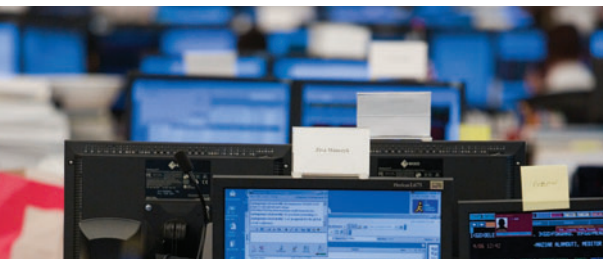
to back. Features of the architecture include the following:

- Consistent information (data) model from front to back, and across cash-traded and over-the-counter (OTC) derivatives products
- Standardized services (feeds) for processing trade, risk, finance, compliance and operations information
- Straight-through processing for market-facing infrastructure by using industry-standard protocols

The near-term reality is starkly different from the ideal for many firms. The good news for them is that they can implement some tenets of next-generation architecture. And they can do so early for regulatory-related projects by agreeing on a standard approach using complex event processing (CEP) technology.

Next-Generation Architecture
Firms should make early decisions on component standards as they implement them. These decisions should be part of a cooperative, firm-wide architecture approach.

Firms also need a client, counterparty and legal entity model (with accounts and portfolios) that is common, globally consistent and fit for purpose. It is necessary for aggregation and reporting.

As a standard emerges at the firm, near-term projects must adopt the best available representation at the time of implementation—with full transparency to stakeholders. They must also keep current with standardization efforts.

Trading, risk quantification, valuation, risk reporting and transaction information require a common, globally consistent and fit-for-purpose trade and analytics information model. Near-term projects would adopt a lean model intended only for communicating key transaction and economic facts.

Feed integration services would encapsulate the trade and analytics information and client, counterparty and legal entity models. As projects contribute their requirements, they would also document and amend

CEP is generally known for algorithmic trading, but it is also suited for feed integration services.

models to capture business rules across trades, analytics, risk measurement and aggregation.

There are process requirements for implementing both intra- and end-of-day workflows. These would document producer and consumer information. They would also orchestrate data state policy and transaction information with market and reference data.

Adopting New Technology

CEP is generally known for algorithmic trading, but it is also suited for feed integration services. CEP allows rapid integration of numerous and diverse data sources—with rules-based processing—into a consistent data model.

CEP also lets users act on external events, such as a credit downgrade or limit breach, to alert business stakeholders.

Projects and change imperatives that could benefit from a

cooperative approach and CEP technology include the following:

- **Capital requirements:** Analysis, inputs and capture
- **Limits:** Cross-entity, affiliate and cross-border
- **Risk:** Exposure and analytics
- **Operations:** OTC derivatives clearing interfaces

High-performing capital markets firms are examining their options and taking action. They will require a new level of cooperation and efficiency across business lines, operations and IT. Firms that adopt a consistent and global approach to next-generation information architecture will be more efficient, better able to pursue new business and more nimble in the face of new regulation. ■

Nancy Turbé is a lead in Accenture's Risk and Regulatory Practice. She has more than 20 years of experience working with and for capital markets companies. Turbé has managed full phase development of complex financial systems from business requirements through production. And she has successfully managed the operation of mission-critical systems for trading and risk. Turbé is currently working with Accenture clients on business and technology change programs in response to regulatory drivers.

Real-Time Data at a Glance

To make the best decisions, managers need data visualization tools that are designed to work with CEP engines rather than the simplistic charting tools of most dashboard software systems.

The simplistic charting tools included in basic spreadsheets and most dashboard software systems are not robust enough for electronic trading. They cannot present real-time data in a complete, understandable way, nor do they support useful analysis in a short amount of time.

Hugh Heinsohn
Vice President,
Panopticon Software AB

Introducing complex event processing (CEP) into a capital markets operation further complicates data analysis. Quality operational decisions made by traders and their managers—not algorithmic intuition—improves the bottom line directly and immediately.

Firms can maintain control over their high-frequency trading endeavors by using online analytical processing (OLAP)-enabled data visualization tools. These solutions are designed specifically to work with the real-time output of CEP engines in a capital markets environment.

Searching for the Truth

Capital markets firms must handle and analyze huge amounts of data and make good decisions quickly, taking into account factors such as risk, liquidity and portfolio balance. Traditional reporting and visualization tools cannot provide human decision makers with the low-latency visibility they need to support timely and accurate decision making.

CEP technology offers the ability to predefine complicated, multidimensional business logic. CEP engines can greatly reduce the amount of data that must be analyzed, but their outputs are usually real-time streaming feeds. Simple charting tools are inadequate for presenting this type of real-time data.

Users need tools that quickly and efficiently foster comprehensive

CEP technology offers the ability to predefine complicated, multidimensional business logic.

understanding and support useful analysis. Some managers spend precious hours wading through paper reports showing yesterday's activity, while others work with the equivalent of paper reports on their screens.

Unconnected data silos can result in large numbers of spreadsheets on different machines or stored in different email messages. They all contain similar—but not identical—information. This propagation problem can easily lead to costly misunderstandings and time-wasting confusion.

A better approach utilizes a centralized database-driven system that supplies a single version of the truth, while letting users easily customize the way they interact with the data.

Firms seeking to make better informed decisions at all levels are integrating visual data analysis software that is designed specifically to handle real-time information. Data visualization techniques provide highly efficient analysis of complex real-time and historical time-series data, allowing users to interactively filter, drill down and change hierarchies on the fly, as well as expose trading patterns, anomalies and risk exposures in minutes.

Using a CEP/Data Visualization Platform

Buy-side and sell-side firms use platforms incorporating CEP and OLAP-enabled data visualization tools for the following:

- Market risk
- Credit/counterparty risk
- Liquidity risk
- Trading and execution
- Compliance and fraud
- Performance and attribution
- Profitability
- Research and sales

In addition to CEP and data visualization components, most of these applications incorporate other systems and data repositories,

including column-oriented databases, real-time feeds and message buses.

Providing Flexibility and Visibility

Users in a fast-moving trading environment need analytical systems that they can easily adapt to their particular needs. They must be able to access the data quickly, without IT intervention and without dissemination of similar-but-not-identical versions of data sets and visualizations that support operational decisions. Spreadsheet software and similar programs offer an immense amount of analytical power and flexibility, but version control becomes an enormous challenge when small differences between circulating spreadsheets easily creep in.

One advantage of the platform-based approach is that the visualization front end can be connected to CEP engines,

OLAP-enabled data visualizations
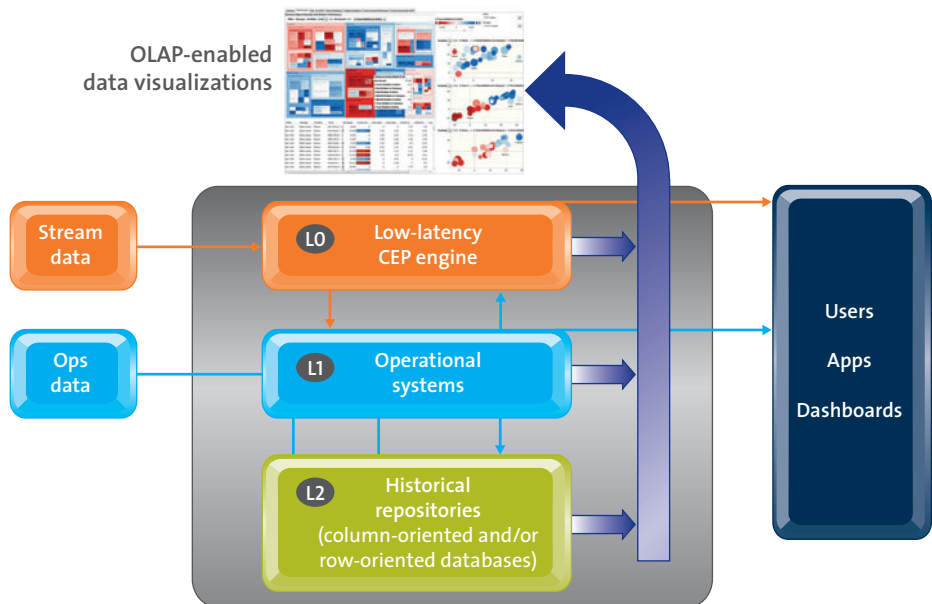
Source: Panopticon Software AB

Real-Time Visual Analytics: A typical platform incorporates OLAP-enabled visual data analysis software, CEP engines, column-oriented databases, row-oriented databases and real-time stream-ing feeds. Traders, managers and analysts can make comparisons with historical data and with other equities, isolate unusual trading behavior and market anomalies, and identify trading opportunities.
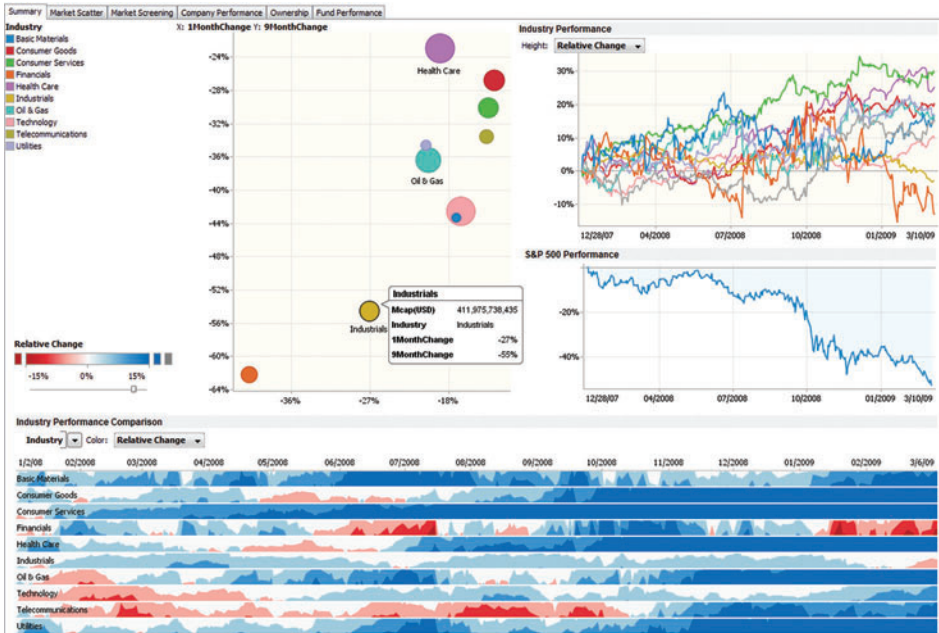
Dashboards of Data: A multitabbed dashboard provides users with the ability to visually analyze multidimensional data. Users can filter out irrelevant information to expose hidden patterns.

incoming market feeds, trading data from internal systems and historical databases. Users have complete control over the generation of new calculated columns of data: how information gets displayed, which subsets of data are accessed and more.

This flexibility provides users with all the tools they need to customize their views and interaction capabilities for all available data while substantially mitigating or even eliminating the version control problems associated with spreadsheets. The right system makes it easy for users to share their configurations, views and findings with other users while maintaining direct connections with the most accurate, current data available. ■

Hugh Heinsohn is vice president at Panopticon Software AB. Before joining Panopticon, Heinsohn was president of U.S. operations for Digital Vision, and he was president of Xytech Systems.

Raw Tick Data: Too Much Information

Complex event processing can deliver specifically configured, enriched and vital information to business-critical applications in a timely manner.

True high-frequency trading processing consumes high-message-rate streams of raw market tick data. However, informative market state summaries can often offer an alternative to processing raw market tick data. These enriched data streams provide vital information to front- and middle-office systems at greatly reduced message rates.

Increased market-tick-data message rates should not be confused with increases in the rate of information transfer. An example of this dichotomy is found in high quote-to-trade ratios seen in almost all markets today.

As market-tick-data message rates increase, front- and middle-office systems are under mounting pressure to keep pace with the velocity of trading. These systems are often not designed for, nor do they need, the full-rate, raw market tick data stream.

Complex event processing (CEP) technology delivers specifically configured, enriched information streams to business-critical applications in a timely manner. The message rate is greatly reduced, and

Stephen F. Elston
Founder and Managing Director, Quantia Analytics

the need to process massive amounts of raw market tick data by these applications is eliminated.

Information vs. Data

Useful information must be extracted from raw data. In the case of market tick data, the information content per tick can be low. For example, a single quote tick provides only limited information on price formation or order book depth.

Evidence of the low-information content per message is found in the high and generally increasing quote-to-trade ratio in most

Useful information must be extracted from raw data.

markets. For example, U.S. equity markets, according to NYSE Euronext, typically have a peak quote-to-trade ratio of 3,000 to 5,000. In U.S. options markets, the Options Price Reporting Authority (OPRA) has a peak quote-to-trade ratio of about 6,000, according to information provided by Exegy.

Descriptive statistics summarizing the state of the market are an alternative to processing high-message-rate raw market tick data. These summary statistics can be as simple as the National Best Bid and Offer (BBO) or as complex as an aggregated order book. Regardless of complexity, these summary statistics have high-information content and a much lower message rate when compared to raw market tick data.

Demands on Systems
Some trading systems must operate on a tick-by-tick basis

with ultra-low latency. To keep pace with this trading environment, other front- and middle-office systems and analytics applications must increase the rate at which they produce results. Some examples of these front- and middle-office systems include the following:

- Order management and execution management systems
- Pre- and post-trade analytics
- Risk and exposure monitoring systems
- Limits monitoring analytics

Many of these applications inherently require market state summaries, rather than full-rate raw market tick data. The use of information-enriched streams allows existing business applications to keep pace with trading. The enriched data streams are configured to meet the requirements of each analytical process. This approach minimizes the effort and cost required to move these business-critical systems into the real-time world.

Market Data Enrichment and CEP
Market data enrichment transforms raw high-message-rate market tick data into

High volume, low information per message

High-volume market data feeds

Other metadata: calendar fundamental index constituents

Data enrichment streaming pipeline (CEP)

Reference data

Low volume, information enriched

Consuming application

Consuming application

Consuming application
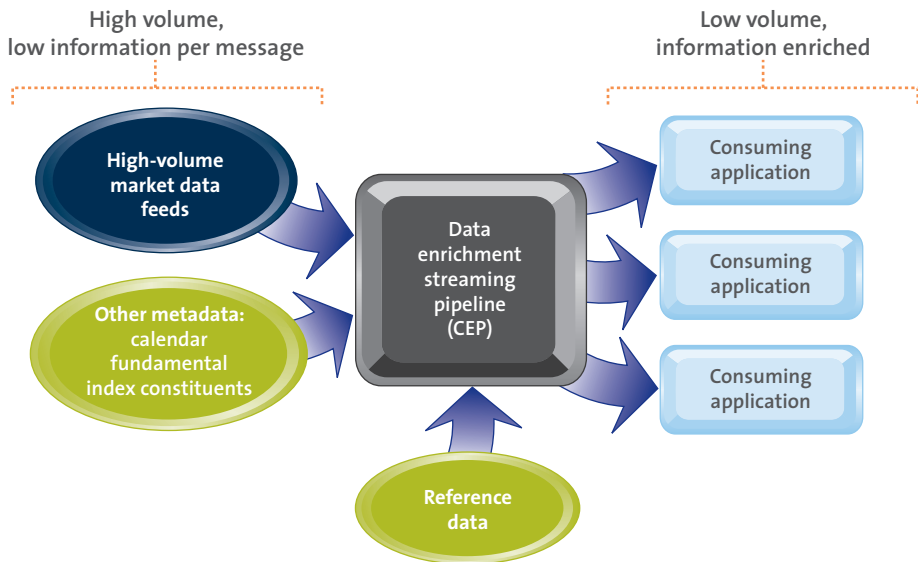
Source: Quantia Analytics

Data Enrichment Streaming Pipeline: High-volume raw market tick data is on the left. Enriched streams delivered to consuming applications—the front- and middle-office systems and analytics applications—are on the right.

low-message-rate, high-information content streams that are fit for each consuming application.

The CEP platform transforms the high-volume raw market data into information-rich streams configured to meet the requirements of the consuming application in a timely manner. Reference data and other metadata required for normalizing, transforming and extracting information from the raw market tick data supports the CEP platform's stream processing.

CEP's flexibility allows the enriched data streams to be rapidly configured to fit the purpose and requirements of each application. The applications receive timely streams of critical market information

without the need to handle the high message rates of the raw market tick data feeds. Message rate reductions can range from a ratio of more than 200-to-1 for open, high, low, close, volume (OHLCV) bars to more than 1,000-to-1 for order book aggregation on large-cap U.S. equities.

Investors use a range of analytics methods to extract information from raw market data and create enriched streams, including:

Investors use a range of analytics methods to extract information from raw market data and create enriched streams.

- OHLCV bars
- Best Bid and Offer
- Time Weighted Midpoint Price
- Time Weighted Average Spread
- Volume Weighted Average Price
- Depth of book
- Aggregated order book

For many front- and middle-office systems, market data enrichment provides an alternative to processing full-message-rate raw market tick data. CEP technology provides a convenient, flexible and high-performance platform for market data enrichment. The CEP platform delivers enriched streams of timely information configured for each front- and middle-office system. ■

Stephen F. Elston is a founder and managing director of Quantia Analytics. A software industry executive for more than 25 years, his experience includes the design, operation and maintenance of sophisticated data, analytic and risk systems. Elston was co-founder and president of FinAnalytica, Inc., which develops, markets and sells sophisticated risk systems to proprietary trading organizations, hedge funds, asset managers and funds of hedge funds in the U.S. and Europe. He served as the vice president of R&D for Statistical Sciences, Inc. (later MathSoft, Inc., and Insightful, Inc.), which commercially developed, marketed and supported the S-PLUS products based on research from Bell Laboratories. Elston holds M.S. and Ph.D. degrees in geophysics from Princeton University and a B.S. in physics (hon.) from the University of New Mexico.

Today's models look at diversification and specific asset classes. Future models must account for the entire portfolio, develop a plan—and designate someone to own it.

The Evolution of Managing Chaos

Like a doctor who smokes, sometimes people have trouble taking their own best advice.

For decades, financial services companies have been advising clients and fund managers to use diversification to mitigate risks and generate value. Portfolios well balanced across regions and assets with quantitative models generally perform much better over time with minimal risk.

However, when it comes to allocating their own capital to proprietary trading, financial institutions have not always done a good job of following their own advice. Note the state of traded mortgage-backed and credit derivative portfolios of leading institutions today.

Most market risk models used at trading desks are generally built around specific asset classes and do not take into account the dynamics of the whole multiasset portfolio. These models consider risks associated only

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Director of
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with specific instruments, such as foreign exchanges or bonds.

The basic practices in risk management are ready for an update. It is time to push cross-asset risk monitoring up the organization.

On Board for Process Reform

The fact that risk management practices need refinement will come as a surprise to no one. Eugene Ludwig of the Promontory Financial Group

recently stated that financial services companies indicate a willingness to invest in modernizing processes and technology in spite of less profitable times.

In fact, the larger financial institutions have audited their internal risk processes and information systems, hoping to identify—and eventually, standardize and deploy—those that

offer the best transparency and risk mitigation. These processes and systems will form the basis of any future reengineering initiative, and they will set the bar for the industry as smaller firms rush to follow suit.

Reengineering the risk management function is not only about choosing the best

It is time to push cross-asset risk monitoring up the organization.

processes. Indeed, when it comes to risk modeling and mitigation, two basic conversations occur:

- How are we measuring its effectiveness?
- Who has ownership of it?

Given the role that oversight (or lack thereof) played in the global credit crisis, it should be apparent that the second question deserves as much attention as the first.

Recent trends show that organizations typically pass the

The combination of top-down, end-to-end visibility and board-level actionable authority can provide the organization with the best possible protection against calamity.

ownership of risk monitoring and mitigation down to line-of-business managers. But their view of risk is fractured at best. Each manager can look at only a slice of the risk picture, and managers are sure to be influenced by the individual P&L requirements of their departments. These managers need tools and processes to understand risk distribution and mitigation in the context of a broader portfolio, so they can manage their own risk taking.

Risk Heads to Committee?
To address this need, firms must facilitate a heightened focus on risk management at the board level and downstream where trading transactions occur. This board-level oversight on governance, risk and compliance

likely will take the form of a committee similar in mandate to those that have been established recently on compensation and audit.

Committee or no, organizations must come to grips with the fact that executive management has traditionally been too far removed from the discussion of risk. The critical factor in the solution will be providing top-level decision makers with access to granular, transactional data from across the organization and all asset classes—securities trading, loan approvals and so forth.

These data will compose a highly accurate risk profile that can be built up and kept current to the balance sheet at both the P&L and enterprise levels. The balance sheet exposure at both levels must be transparent, current and recomputable on demand.

The importance of the enterprise view cannot be understated. Here, these data would facilitate decisions, such as instruments to which an institution might commit traded capital and in

Reengineering software systems and processes—and then training staff to use them well—is a rigorous process.

what allocation ranges, as well as the limits for accepting additional risk in different categories.

The combination of top-down, end-to-end visibility and board-level actionable authority can provide the organization with the best possible protection against calamity and, over time, restore consumer and shareholder confidence.

Compliance, Stability, Confidence

None of this will happen quickly. The incentive to change exists in organizations today, but organizations could take two to five years to make significant progress. Reengineering software systems and processes—and then training staff to use them well—is a rigorous process.

The early signs of change will be incremental improvements in method and procedure. However, these early changes and the quality of the implementations and enforcement will foretell much about the long-term transformation that risk reform will achieve.

The immediate goals are to reach compliance with major regulations that are already in force, including Dodd-Frank, Markets in Financial Instruments Directive (MiFID) and Basel III. And, of course, to

deliver highly credible balance sheets that will encourage ratings agencies to evaluate them favorably.

There is also a more elusive goal: undoing the damage of the last few years and restoring investor and consumer confidence. Just saying that reform is under way will not be enough. Laypeople will not be comforted by recondite promises of aggregated real-time risk data. If the industry commits to a top-down, principles-driven approach that verifiably results in market stability, investor confidence will eventually follow. ■

As director of business development for financial markets at Sybase, Sinan Baskan is responsible for developing solutions for lines of business in the financial services sector. He has held various positions in the product engineering, professional services and marketing organizations at Sybase. Previously, he worked at HSBC Corporate Investment Bank on risk analytics.

The Hunt for Yield

The global fiscal crisis has shown that firms need a strategy plan and monitoring system for risk to ensure resiliency in a new environment.

Global regulatory changes are fundamentally altering both the investment banking business model and the role of risk management. The shape of future regulatory changes never formalized following the post-crisis rebound of the fixed income markets. Now an era of overcapacity is significantly pressuring the margins. Consequently, the strategic choices and investments made in risk management capabilities over the next two to three years will shape the success of individual firms over the next decade:

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Partner,
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Gordon Mackenzie
Senior Technology
Integration,
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- Tight limits by U.S. authorities on proprietary trading will increase reliance on client-related revenues.
- The Dodd-Frank Act in the United States and the proposed European Market Infrastructure Regulation will push increasing amounts of standardized over-the-counter (OTC) derivatives onto organized platforms and through central clearing, which will reduce margins on these products.
- Basel III will increase the risk-weighted assets (RWA) requirements of firms. This will be particularly noticeable in relation to the trading book, counterparty credit risk and securitization. It will also increase the Tier 1 ratio requirement while narrowing the definition of balance sheet items and financial instruments that qualify as Tier 1 capital.

- Firms viewed as posing significant systemic risk are likely to incur additional regulatory capital requirements.

Some firms have embarked on the so-called flow monster strategy to capture significant amounts of vanilla flow volume and achieve economies of scale to minimize cost per trade. This strategy requires significant investment to implement seamless STP environments and effective electronic trading platforms. But these investments

can increase market penetration and improve client connectivity.

However, not all firms will be successful with the flow monster strategy. The industry cannot likely support more than three to five of these platforms. Plus, these firms may fall under additional regulatory interventions if regarded as systemically important financial institutions.

After sustained low interest rates and global capital imbalances, any return to an investor hunt for yield will drive increased appetite for exotic and structured credit products from their recent lows. The proof is in the reemergence of covenant light leveraged loans and the securitization market. But these business lines will be subject to more punitive regulatory capital charges under Basel III.

Client volumes and trading revenue are highly correlated with investor risk appetite, which can fluctuate quarter by quarter, resulting in volatile revenues and declining returns on equity (ROEs). Major firms' quarterly earnings announcements throughout 2010 demonstrated this trend.

What About Risk Management and Risk Technology?

According to the 2009 Senior Supervisors Group (SSG) report *Risk Management Lessons from the Global Banking Crisis of 2008*, two key areas for improvement in risk management are:

- Articulating a clearly defined risk appetite for the firm
- Monitoring risk effectively through reliable access to accurate, comprehensive and timely quantitative information

These two areas increase in importance from a strategic perspective in the new regulatory and competitive landscape. The 2010 SSG report, *Observations on Developments in Risk Appetite Framework and IT Infrastructure*, which followed up on progress made by firms in these two areas, commented: "While planned improvements are in progress, it is unclear whether firms will

have advanced these practices sufficiently to be resilient in an increasingly competitive and changing regulatory environment."

This observation has two implications for risk management and risk technology.

The role of the CRO as a strategist. The chief risk officer's (CRO's) role in developing firm strategy will grow. Working with the senior management, business and finance functions, the CRO will be a major contributor, strongly challenging the impact on the business' risk profile. The CRO will also allocate risk capital to business lines, optimize RWA and increase vigilance, making sure the risk appetite is not being exceeded.

Aggregated risk on demand. Aggregated risk on demand is necessary to effectively manage risk and optimize risk capital allocation in an increasingly global and volatile environment. Firms face a number of challenges in achieving this aggregation:

- **Data governance and quality:** Inconsistent and incomplete data makes it difficult to effectively measure and control risk.

Inconsistent and incomplete data makes it difficult to effectively measure and control risk.

- **Outdated technology:** The risk IT platforms of many firms are batch solutions. They typically deliver risk information on t+1. The platforms are not particularly well aligned with the front-office risk systems and the way that the front office views risk. Happily, firms are moving to intraday (or real time for certain high-volume/high-frequency business lines and liquidity) risk measurement and reporting. Technological advances over the last five years, in areas such as memory caching and complex event processing (CEP), make this possible. Still, firms must take a front-to-back approach in designing their risk management infrastructure, as opposed to building it out from the middle office.

How Will Risk Management Look Going Forward?

Firms can establish a strong competitive advantage through more effective risk management and capital allocation. Success will depend on:

- Developing the target business architecture in line with the firm's strategy and regulatory expectations
- Taking a front-to-back approach to design, reducing duplication and ensuring risk metric consistency across the front office and corporate risk

> *Aggregated risk on demand is necessary to effectively manage risk and optimize risk capital allocation in an increasingly global and volatile environment.*

- Treating data as a strategic asset with strong data governance
- Using recent advances in technology to provide more timely measurement and aggregation of risk, which supports more effective decision making
- Influencing the prioritization of spend on risk IT with other initiatives, a number of which are likely to be nondiscretionary or have explicit revenue-generating business cases

Shareholder and regulatory pressure are on the rise. Firms that have made wise risk management infrastructure investments will have a competitive advantage. They will allocate risk capital more efficiently, maximizing risk-adjusted returns while protecting the firm and meeting regulatory expectations.

An adaptable risk IT architecture will be essential to meet future regulatory requirements—which are currently in a state of flux. ■

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industry. Leake's primary focus is working with clients to assist them in their risk transformation programs spanning organizational design, process, methodology, risk architecture design and implementation. Leake is a Chartered Accountant and holds an MSc in finance and investment. He has also been on the board of the Financial Options Research Centre at the University of Warwick.

Gordon Mackenzie is a senior manager within the Technology Integration practice of Deloitte Consulting and has worked with financial services technology for more than 15 years. Mackenzie's current focus is advising clients on the impact of regulation on their existing capital markets architectures. He has experience of both market and credit risk, as well as central counterparty clearing for OTC derivatives and cash equities.

Defining Optimum Capital

Increasing capital adequacy requirements necessitate smart investment decisions that start with business intelligence and an enterprise-wide view of data.

Changing regulations during 2010

disrupted many of the business processes in trading organizations, causing firms to lose hard-earned efficiencies. As these firms look toward the second half of 2011 and beyond, they are already anticipating—and worried about—upcoming regulations that will impose more changes and will need to be implemented rapidly.

Basel III, derivatives market practice reform, Dodd-Frank, as well as regional influences in Russia and Asia where regulations are more stringent are all cresting together and causing banks to address their capital adequacy. With many of the new regulatory requirements coming as early as 2012, panic is not too strong of a word to describe what some firms are experiencing as they assess what systems need to be in place to meet the new requirements.

Counterparty risk, which has been a significant focus since the collapse of Lehman Brothers, is another factor causing banks to reassess their risk exposure. Because of the tremendous inter-connection in financial markets, some banks did not realize for quite some time that Lehman Brothers exposed them to risk. Initiatives are under way with

John Le Hunte
Solution Strategist, Misys

regulators and governments to lower risk through new market practices and central clearing counterparties. All of this will lead to requirements for more collateral and changes to margining.

These multiple concerns are causing banks to move more capital to reserve to ensure capital adequacy. Because many institutions do not truly understand their risk exposure, they have to be more cautious than necessary.

Consolidating Risk Across the Front Office

Aggregating risk numbers can help banks better understand

Because many institutions do not truly understand their risk exposure, they have to be more cautious than necessary.

their exposure to risk. Every bank has a data warehouse or is building one so they can manage and analyze their information across asset classes—but they need another component to address risk. Analyzing business data and market risk, combined with stress testing—all in real time—allows banks to identify where and when to allocate capital, as well as their risk levels. Having this additional business intelligence helps banks understand which business units are delivering the highest and lowest returns on investment of capital suballocated by the banks to their business units. A holistic view of total risk provides these critical types of information.

Few banks, unfortunately, have a holistic view of their business data. Banks' trading operations are historically desk based, and they have multiple systems covering all the instrument classes. This silo approach causes duplications and results in an inflated capital adequacy figure that allows fewer funds for reinvestment. Interdependencies between market risk factors, credit spreads, probability of defaults and so on also affect liquidity in the market.

Data aggregation can help banks move toward a model that allows them to see all risk factors. One way to accomplish this data aggregation is to start with current systems and feed the data into a single platform that takes market and credit risks together, then builds an economic capital calculator. Many banks want to keep the systems they have already invested in and combine these with a central data warehouse. This type of enterprise risk management system will fully analyze market and credit risk together and provide a business intelligence layer that enables comprehensive reporting and analytics. These reports can provide information about return on investment of capital in different business units, as well as required reporting for oversight agencies. A model that takes into account the causality and interdependencies is a must for a holistic economic capital calculation.

Consistent Pricing and Valuations

One approach to creating an architecture that provides a holistic view is to keep the pricing by product within each

desk-based system, which the central risk system can then use as a service while performing risk calculations such as Monte Carlo simulations. This approach has the advantage of avoiding pricing inconsistencies between the systems. Moreover, this approach allows the transaction interface to be generic and not product related. Using this scenario, firms can introduce new products into the risk system quickly.

Another approach, perhaps more purist, is to have separate valuations within the risk management system. This approach provides complete independence to the risk system and enables the risk system to verify the valuations from the front-office systems.

Perhaps the ultimate solution is to have an independent component—a pricing factory—that contains the pricing functions as libraries that the front-office systems, the risk system and the accounting system can use. All the systems do not need to use the same pricing libraries, however; many versions of pricing libraries could be designed for various purposes. The key aspect of this architecture is that all the

> *A model that takes into account the causality and interdependencies is a must for a holistic economic capital calculation.*
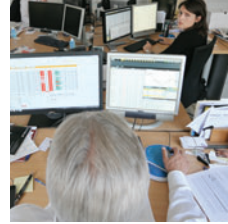
versions are centrally located with version-control mechanisms. This architecture enables consistency across the enterprise by eliminating pricing hot spots and supports new pricing libraries to be incorporated easily across the enterprise.

Less Risk, Optimum Capital

How firms leverage technology will define their success in the new regulatory environment. Business intelligence and an enterprise-wide view of risk exposure provide the knowledge that banks need, so they can apply capital calculations and set aside the minimum amount of capital. With the appropriate amount in reserve, banks will have the maximum capital available for making investments and the confidence to survive—and succeed—in the changing regulatory landscape. ■

John Le Hunte is a solution strategist at Misys. He has specialized in the Misys Summit solution for the past 13 years, further developing his expertise in over-the-counter (OTC) derivatives and risk management. Before joining Misys, Le Hunte spent 11 years with Reuters designing and selling capital markets solutions primarily for trading and risk. Le Hunte previously worked for major banks as a trader for 8 years.

A Phalanx for Your Portfolio

A wide array of robust strategies and procedures is crucial to mitigating risk and protecting portfolios against market stress.

Managing market risk is more than evaluating exposures and anticipating losses. Stressful market conditions like those during the 2008 credit crisis involve loss of liquidity, ballooning counterparty exposures and margin calls, and forced sell-off of assets at deep discounts. Although useful as a first line of defense, parametric value at risk (VAR) is not enough to protect portfolios against extreme volatility, since it fails to take these knock-on effects into account and is deficient in measuring the full scope of portfolio risk.

Today's risk professional must use a diverse range of techniques to manage risk.

VAR
VAR limits are breached when something new occurs—a liquidity crisis, bankruptcy, an unexpected economic number—and the market instantaneously enters uncharted territory. VAR cannot anticipate such events, but rather assesses risk given current conditions. However, VAR can still serve as an early warning.

Any significant change in VAR is a sign that either correlations and volatilities have altered or a portfolio's risk attributes have changed. Thus, a significant movement in VAR from one day to the next signals the need for immediate investigation. There may be unintended sector exposures, sensitivities to the price of oil or short-term interest rates and other factors. A change in VAR may not indicate which factors you are exposed to, but it can warn of a new exposure.

Stress Tests
Stress tests should include all market inputs relevant to a portfolio and strategy. A scenario that simultaneously stresses multiple factors must correctly incorporate the joint behavior under extreme conditions.

Lance Smith
CEO,
Imagine Software

*A change in VAR
may not indicate
which factors you are
exposed to,
but it can warn
of a new exposure.*

For example, a typical convertible arbitrage fund that trades stocks, convertibles, equity options, bond futures and credit default swaps (CDS) monitors the following:

- Equity prices
- Implied volatility
- CDS spreads
- Default risks
- Yield curve exposures

An appropriate stress test might drop the stock price 10 percent and increase the CDS spread by 200 basis points, simulating a sudden deterioration in credit quality. But what about implied volatility? For options, an increase of five points would be appropriate. For the convertible bond, the implied volatility is likely to drop as investors sell out of their bond positions. This is because the volatility arbitrage in convertible bonds is not as tight as it is with

ordinary options, so liquidity issues can dominate. Thus the implied volatility corresponding to the same underlying stock can actually move in opposite directions, depending upon security type.

Stress tests should be carefully designed to model the market dynamics of a particular holding, portfolio or strategy. Access to quality historical data plus personal expertise is critical, but a risk management system should enable user-specified stressing of underlying factors. If you can ask the question, you should be able to compute the answer.

Liquidity
Under stressful conditions, liquid securities become less so; the effect is magnified with securities that were originally illiquid. There are two consequences:

- Effect on mark to market
- Possible need to unwind at unfavorable prices to meet margin calls

To address these issues, analyze positions by liquidity buckets. An equity long-short fund will want to ensure that a sufficiently large position

exists in its most liquid bucket to cover potential margin calls; the size will depend on the existing degree of leverage.

Historical Simulation and the Empirical Distribution

Historical time-series data of underlying risk factors (such as stock prices) is used to perform the following:

1. Compute correlations and volatilities
2. Replay specific historical scenarios (such as the crash of 1987)
3. Generate an empirical distribution

In the first case, the correlations and volatilities are used in a parametric VAR calculation. The second case is straightforward; however, the concept of empirical distribution may be unfamiliar. (Unlike parametric VAR, an empirical distribution makes no attempt to fit a distribution to a bell-shaped curve. It just is what it is, fat tails and all.)

In an historical simulation, the positions in the portfolio remain static: no trading, no re-hedging. In a dynamic marketplace, this scenario may not be realistic. In an extreme situation, you might stay the course if there were absolutely no liquidity or if you were willing to make a huge bet that the market would recover. The empirical distribution makes no such assumption, because it assumes that each day begins with the current exposure.

Monte Carlo Simulation

Monte Carlo simulation is akin to parametric VAR, only computed for nonlinear products. It depends upon the same inputs as VAR—volatilities and correlations of underlying risks—but takes convexity and optionality into account. When you use Monte Carlo simulation as part of a rigorous risk management protocol, be aware that it, like parametric VAR, relies on an assumed distribution for underlying risks and should be augmented by appropriate stress tests.
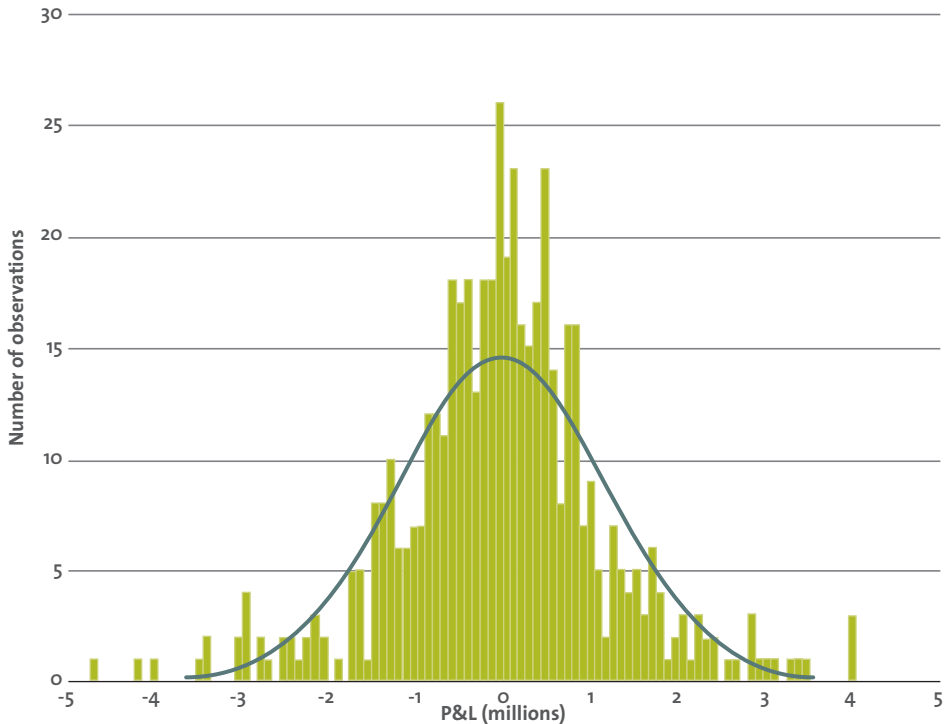
Source: Imagine Software

Comparing Empirical Distribution to Equivalent Normal Distribution: An empirical distribution makes no attempt to fit a distribution to a bell-shaped curve.

On-the-Fly Analytics

In the typical dynamic market, predicting everything is impossible. Unanticipated situations, unexplained changes to P&L or a market move that is not yielding expected returns may arise. On-the-fly analyses can reveal what is happening so that trading strategies can be modified. With proper

tools, you can quickly and effectively analyze ad hoc situations. Understanding everything possible about your portfolio is essential.

Tail Vega

Consider a long volatility book of options. The market has just undergone a sharp rally, yet mark to market is negative. Why? It might be explained by option positions in the "tails"—particularly out-of-the-money call options such as a significant change in their implied volatility that has hurt

P&L more than the benefit from the increase in underlying volatility. A calculation that returns only the vega (volatility sensitivity) of deep out-of-the-money options just before the rally can quantify the effect. Such an ad hoc calculation might be to compute the vega only if the delta (in absolute value) is less than 5.0 percent and otherwise ignore the position.

Hidden Exposures

Determining exposure to a particular company—let alone sector—is not simple. Exposure can come from investments in stocks, CDSs and other

securities with the same issuer as well as through exchange-traded funds (ETFs). The stock may be a component of one or more ETFs or an equity index on which a trader has sold options. It is important

to be able to examine basket securities' underlying components to properly assess exposures.

Diversify, Diversify, Diversify

Market behavior can change dramatically at any time, as seen during the credit crisis and the present state of sustained volatility. Risk management that is one-dimensional, such as VAR, or

Determining exposure to a particular company— let alone sector— is not simple.

based on an assumption of precise knowledge of the distribution of returns is insufficient. Instead, diversify your risk management by using a wide variety of tools appropriate to particular strategies that complement, augment and compensate for each other's weaknesses.

Risk cannot be reduced to a single number. Portfolio risk is multidimensional and must be analyzed from many perspectives,

Portfolio risk is multidimensional and must be analyzed from many perspectives.

along with its behavior under many circumstances (for example, stress tests). Designing meaningful stress tests requires experience, access to quality historical data and an ability to calculate the effects of shifting several risk factors simultaneously.

Historical simulations are helpful, but the ability to generate an additional empirical distribution will help avoid the "stay the course" assumption and give a complementary evaluation of your risk.

Remember: Real-world risk management is dynamic. No matter how hard anyone may try to anticipate potential problems, the market is ultimately more creative than any individuals. To manage and mitigate risks, have proper tools and procedures that enable real-time reaction and investigation, and also probe for underlying weaknesses that can undermine portfolios given a

particular set of conditions. With robust systems, procedures and personnel in place, your firm will be better equipped to navigate safely through the next storm. ■

Lance Smith, CEO of Imagine Software, sets strategic direction, guides the development of cutting-edge analytics and lends his expertise to sales efforts. Smith brings a rare combination of business and academic experience to his role as CEO, with more than 25 years of direct involvement in trading and risk management practices, mathematical modeling and system development. Before co-founding Imagine in 1993, he began his business career in 1986 as a Solomon Brothers vice president, gaining diverse business experience in mathematical modeling, proprietary trading strategies, structured products and risk management methodologies.

The Inspired Side of Modeling

Building a successful portfolio management model means thinking creatively, the way you would in any other risk/reward endeavor, such as golf.

Risk management is a key component in managing a portfolio. Investors want to be able to assess how much money they should invest, and how, to maximize returns at a particular level of risk. To help them make decisions about these variables, investors often use financial models.

Mark Broadie
Professor,
Columbia Business School

Market Risk vs. Model Risk

Market risk, the risk that the value of a security or portfolio will decline in the future, is often estimated using a financial model. Model risk refers to the additional risk that occurs when the financial model underestimates or completely misses some features in the real-world market.

Most risk management systems must have all the data and formulas built in, but model risk involves thinking outside the box—what isn't in the system, or what isn't represented, that could be a risk. In the recent financial crisis, many mortgage-backed securities were rated AAA based on financial models that underestimated the impact of housing price risk. Model risk is really about what risks aren't incorporated into the risk management system and trying to identify places where these risks could be encountered.

Causes of Model Risk

Model risk has several causes. One is tail risk, the underestimation of extreme market moves (see Figure 1). For example, a financial model might assume that returns follow a normal (or Gaussian) distribution and assess risk accordingly, but in reality, returns deviate from a normal distribution by having fatter tails. That is, the model may predict a market crash once in hundreds of years, when, in reality, financial crises happen far more frequently. Tail risk can also occur when using historical data, because historical data may not include extreme events that could happen in the future.

Figure 1: *Tail risk is the underestimation of extreme market moves.*

Correlation risk is about financial contagion. Correlation measured during typical market periods often severely underestimates the benefits from diversification. In periods of financial stress or crisis, markets tend to become more highly correlated. That is, markets tend to crash together and diversification fails when it is most needed.

Survivorship bias occurs when risk is estimated by the performance of surviving firms or funds. This produces model risk, because future performance is unlikely to match the past.

Error maximization leads to another form of model risk when a portfolio optimization procedure overweights securities that appear to have higher expected returns—and smaller risk—than they have in reality (see Figure 2).

Hidden optionality creates model risk when a hedge fund adds alpha by investing in a strategy with skewed returns (for example, by selling options). Quarter after quarter, this strategy provides incremental returns—or alpha—compared to a benchmark. The true

Model risk

Average portfolio return

Standard deviation of portfolio return

■ True efficient frontier   ■ Estimated efficient frontier
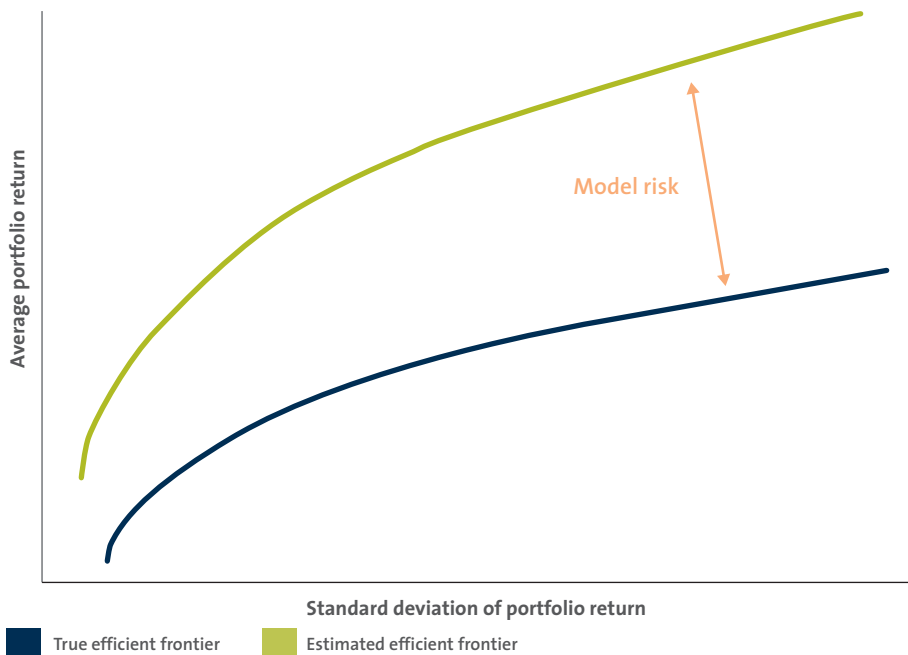
Source: Mark Broadie

Figure 2: *Error maximization leads to another form of model risk.*

nature of the strategy may remain hidden until the fund suffers a severe loss.

Asymmetric information—when either the buyer or the seller has better information— creates model risk, because the drive for a higher yield often comes at the cost of extra (hidden) risk.

Minimizing Model Risk...

Investors want to maximize average portfolio return, choosing the best securities for a given level of risk. To minimize model risk, they can do the following:

- Perform a sensitivity analysis, in which they check the sensitivity of results to the parameters and distributional assumptions.
- Use a bottom-up approach by aggregating the risk from individual securities (including options) to the portfolio.
- Think outside the box by considering scenario analysis or stress testing.
- Be aware of the many causes of model risk.

Are amateur golfers good strategists? Apparently not.

■ Understand that good data, software and analysis can minimize model risk and lead to better risk management decisions.

...Applied to Golf

The principles of risk management can be applied to endeavors other than portfolio management. Think about golf, which also has risk-reward trade-offs. Golf strategy (often called course management) requires an estimate of the distribution of possible outcomes, or shot pattern, together with an objective assessment of the risks presented by a hole.

Consider, for example, a hole with out of bounds along the right side of the hole, but the left side of the hole has only rough that comes into play. The golfer needs to weigh the reward of a possible par or birdie with a drive down the middle of the fairway, with the risk of a shot sailing out of bounds to the right. Because of the large penalty associated with hitting out of bounds, golfers should

adopt a safer strategy by choosing a target farther to the left, away from the out of bounds. This less risky strategy will lead to lower scores, on average.

Are amateur golfers good strategists? Apparently not. My research shows that golfers hit two to ten times more shots out of bounds than is optimal and lose many strokes from poor strategy. The reason could be model risk: Optimistic golfers consistently overestimate their own skill. Another possibility is that golfers knowingly play strategies that lead to higher average scores, because they derive more pleasure from a drive in the fairway with the possibility of a par or birdie, even if it carries a greater chance of a double or triple bogey. However, for those who understand model risk, strategizing to improve a golf game—like strategizing to improve a portfolio—is entirely possible. ■

Mark Broadie is the Carson Family Professor of Business at Columbia University. He received a B.S. from Cornell University and a Ph.D. from Stanford University. His research addresses issues in risk management, the pricing and hedging of derivative securities, and asset management. He serves on the editorial board of Operations Research, Finance and Stochastics *and other journals and was the editor-in-chief of the* Journal of Computational Finance. *Broadie has given seminars and courses for financial professionals throughout the world and has consulted for numerous financial firms.*

On the Horizon of OTC Derivatives

Credit valuation adjustments are the most prudent way to manage short-term counterparty risk—at least until the dust settles from Dodd-Frank.

As evidenced by the list of casualties of the recent crisis, the management of counterparty credit risk could be considered significantly woeful. Although broad steps are being taken to mitigate the effects of counterparty risk—namely, through central counterparties (CCPs)—what may be of greater near-term importance is the mitigation of risk through credit valuation adjustments (CVAs).

James J. Jockle
Senior Vice President, Numerix

With the passage of Dodd-Frank, it is clear that regulators expect that the derivatives markets can be "managed"—thus reducing systemic risk—through standardization, transparency, centralized reporting, exchange trading and central clearing. While all of these efforts lead to an efficient derivatives marketplace, the key challenge is the inherent nature of risk, risk management (specific to an institution) and risk taking. Moreover, how can a market—which has operated in opacity—quickly reinvent itself?

Finding a Fix

Over the past year, the industry has rallied to try to solve the problem. Industry groups such as the International Swaps and Derivatives Association (ISDA) have worked to bring new transparency to the industry. Credit default swaps have moved to central clearing institutions. The financial products markup language (FpML) initiative to streamline the process of supporting trading activities through an e-business language has been reinvigorated. New CCPs have been formed and have gained regulatory approvals, and enhancements to electronic swap execution facilities have been made to meet reporting requirements. But in looking ahead, the two key variables to success are time and prudence.

Dodd-Frank was a watershed moment for the regulators of

Until a new paradigm can be fully realized, CVAs are the most practical approach for managing counterparty risk in the near term.

the derivatives market. However, regulators need to exercise care and restraint to ensure that the market moves prudently. Specific to exchanges, regulators need to ensure that their CCPs are not compelled to clear contracts that are either beyond their capabilities (from a risk management perspective) or uneconomical for end users. Although regulators have the power to accelerate the move to central clearing through the use of punitive capital charges for those over-the-counter (OTC) derivatives that are not centrally cleared, the expression "evolution, not revolution" becomes the most prudent way forward. Until a new paradigm can be fully realized, CVAs are the most practical approach for managing counterparty risk in the near term.

Market Credit Valuation Adjustments

CVAs are essentially a capital charge imposed by an institution on a per-trade level. When applying CVA adjustments to a portfolio, all risk factors need to be accounted for—namely, the OTC contract's underlying volatility, the counterparty credit spread volatility and the correlation between the underlying volatility and default volatility of the counterparty. At the most basic level, market CVA is defined as:

CVA at each time bucket = PV (EE * (1 – Recovery Rate) * Probability of Default)

Where:

- EE is the Expected Exposure at each time bucket
- Recovery Rate
- Probability of Default (derived through credit modeling)
- Market CVA can be calculated as unilateral/ bilateral

The challenge is to compute accurate exposures. The entire portfolio must be simulated using a

consistent set of paths for all factors and for a large number of time steps. Moreover, to model credit events, the number of paths for which default occurs in simulation must be large to get accurate loss statistics. As a result, up to millions of paths will be used in the simulation. To solve this challenge requires considerable computational power (hardware), data and prudent data management and a hybrid model framework.

Hybrid Model Framework

A hybrid model framework offers a high degree of flexibility in the selection of single- and multifactor models across *n* economies for baskets of arbitrary size. Within this structure, the user may select the best model for each underlying framework and then use these component models as building blocks to create the hybrid model.

To demonstrate, let's consider a hypothetical portfolio with exposure to multiple equity, interest-rate and FX-rate underpinnings (see figure). Based on the instrument characteristics, the user selects these models:
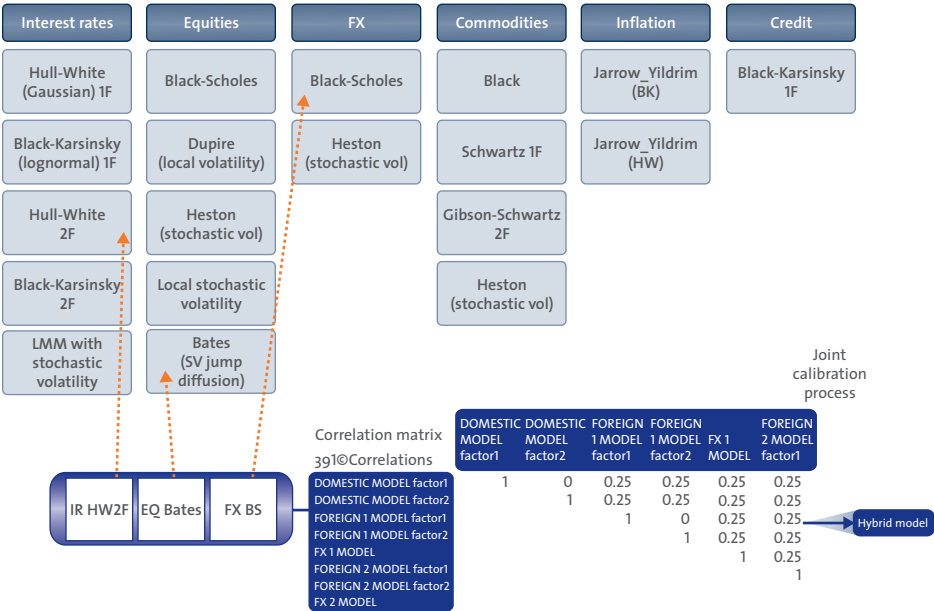
Source: Numerix

The Hybrid Model Framework: A sample portfolio with exposure to multiple equity, interest-rate and FX-rate underpinnings.

- Hull-White two-factor interest rate model for each currency
- Bates stochastic volatility jump-diffusion model for equity indices
- FX Black-Scholes model for each currency pair

The user then defines the correlation between the risk factors through a matrix that links the component models. Each model is first individually calibrated, and then a joint calibration is applied when the hybrid model is built— a critical step that captures correlation to ensure that each volatility factor is represented in a market-consistent manner.

The Importance of CVAs

Although the OTC derivatives market of the future will not operate as it does today, the assessment and management of counterparty credit risk and their impact on the pricing of instruments will be of continuing importance. Looking ahead, more and more instruments will be centrally cleared as CCPs expand their risk management capabilities and introduce wider instrument support, but there will always be a market that lives outside

Credit Valuation Adjustments

A credit valuation adjustment (CVA) is the adjustment to portfolio value due to the risk of counterparty default. In other words, the CVA is the market price of credit risk and is determined by both the exposure and the probability of default.

A unilateral CVA includes the other party's risk only and is always a negative adjustment to portfolio value.

A bilateral CVA takes into account both parties' risk and may be positive or negative. Bilateral CVA works in favor of parties with weak credit, because the price of their pay leg is reduced on the open market, but the price of their receive leg is not. This results in higher deal unwind value for them.

of that framework. CVAs are critical to the long-standing health of the industry, bringing counterparty risk management to the trading floor. ■

James J. Jockle of Numerix leads the company's global marketing efforts, spanning a diverse set of solutions and audiences. He oversees integrated marketing communications to customers in the largest global financial markets and to the Numerix partner network through the company's branding, electronic marketing, research, events, public relations, advertising and relationship marketing.

Having timely information is not simply a competitive advantage. It is a survival necessity in a highly competitive global environment.

The Race Against Time

The post-crisis trading environment has industry pundits decrying many issues that have global implications, including cross-border risk management, ill-conceived approaches to market oversight and U.S. markets ceding valuable competitive ground. But at the heart of all the arguments swirling around Wall Street, Main Street and Pennsylvania Avenue is one irreducible point: time.

More so than at any other point in history, time is the friend and enemy of capital markets. And nowhere is the brute force of time playing out with more intensity than in the furious pursuit of quality real-time data in today's high-performance trading environments.

Managing the Data Deluge

Before organizations can fully address the performance challenges of real-time data access and analytics, they must address the quality and volume of the data to be analyzed. But the sheer volume and persistent incongruity of formats and sources severely complicate the task of aggregating and structuring that data.

Dr. Raj Nathan
Executive Vice President,
Chief Marketing Officer,
Sybase, an SAP Company

A complement to market data, event data provides a comprehensive view of current world events.

Beyond the data deluge itself, a host of factors complicate the rush to greater feeds and higher speeds. The escalating hunt for quality real-time data is happening at the same time that other essential parts of the trading data/IT landscape are transforming themselves. Among the most important of these transformations:

- More Wall Street trading activity than ever is moving from public markets to private exchanges, where co-location and other factors fuel competitive access to real-time data. The NYSE currently handles roughly 25 percent of all trading on its own listed stocks, compared with 80 percent just six years ago. At least three dozen off-exchange venues have emerged in the last several years.
- Hardware acceleration and other technology advances, under way well before the financial crisis, are pushing feeds and associated analytics to the limits of physics, testing how much faster electrons—and therefore trading orders—can move through the wire.
- The evolution of complex event processing (CEP) over the last several years from nascent trend to a fact of life has had substantial implications not only for the trading life cycle, but for the vendor community as well.
- And there is the quest for smarter, faster, event-driven analytics through unlimited access to growing pools of structured and unstructured data.

The uniquely complex ecosystem of expanding capabilities and shifting alliances that define this arena is the focus of attention on the following pages. The authors of these articles look at several constituent parts of the real-time data ecosystem with a view to how these parts are shaping today's active capital markets world.

Reimagining Data…
After decades of resistance, the silo's era seems to be entering the endgame. This places enormous attention on data extraction and execution from operational and outside sources not historically seen as integral to the front office P&L. The existence of unstructured or semistructured data calls for reimagining traditional relationships between formerly disparate parts of the enterprise.

This chapter also examines event data and its role in trading strategies. A complement to market data, event data provides a comprehensive view of current world events. Using the very latest computing technology to evaluate and trade upon event data has the potential to impact the capital markets in a material and time-saving way.

...and Putting It to Work in New Ways

The rapid ascent of high-frequency and electronic trading, as well as competition for alpha, continues to drive hedge funds, proprietary trading firms and other asset managers to identify new, differentiated data sets as core contributing factors in their real-time trading models. Firms hoping to prevail in today's markets are turning to new real-time content sets. These reside outside of classic market data paradigms, and firms are embracing them as sources of competitive differentiation.

Event data has crystallized as the leading real-time ingredient that firms are evaluating—and increasingly adopting. The emergence of event-driven models and trading strategies is a particularly strong play for quant-focused firms, which tend to be well versed in rapidly absorbing and integrating data into their trading strategies in real or near real time.

The maturing of CEP, the topic of another article here, reflects the widely recognized importance of identifying event patterns and abstracting them in formalized ways—ways that can

Time will wait for no one.

be consistently employed in real time. High-performance analytics databases will share an increasing amount of infrastructure with CEP technology. This chapter explores how such sharing increases efficiency by analyzing data as it streams and before it is stored.

From visualization tools to frameworks, new instruments are emerging to help both professional developers and end users save time by rapidly developing and deploying analytics applications. This chapter also discusses a new analytics programming language that does just that.

The imperatives of delivering and analyzing real-time data at unprecedented speeds and volumes drive much of today's capital markets agenda, in ways both manifest and as yet unrecognized. This is the time when the industry will determine just how quickly a trade can execute—and how best to harness that for competitive advantages.

Amid the many questions—and opportunities—these new technologies raise, one thing is certain: Time will wait for no one. ■

As executive vice president and chief marketing officer of Worldwide Marketing and Business Solutions Operations, Dr. Raj Nathan is responsible for all marketing initiatives for Sybase. Under his leadership, Sybase is recognized for visionary technologies that are helping to redefine the capabilities and profitability of the world's leading capital markets firms.

Computers Break the News

The next IT revolution in capital markets may be when computers trade on the news—that they have read and understood.

David J. Leinweber
Principal,
Leinweber & Co.

Anyone reading this guide is already convinced that trading has been transformed by information technology. High-frequency trading reaches to ever-higher frequencies, driven by quantitative information at micro levels.

Fewer headlines herald another information technology revolution in markets: trading and investing driven by events that arrive as qualitative, textual and relationship information. Watson's *Jeopardy!* win is an impressive reminder that computers can be good at that, too.

Using computers to understand news text goes back to the 1980s. Skeptics held to the conventional wisdom "buy on the rumor, sell on the news," implying that prices delivered news before it was released publicly. Academic research on the first 20 years of electronic news confirmed that view, as shown in Figure 1.

The vertical "event line" in the middle of the illustration is the day the news story appears on the wire. The curves show excess returns measured 10 days before and after the news appeared. Each story got a sentiment rating from a venerable academic tool.

The sentiment ratings are remarkably consistent with the direction of price moves. All the green positive sentiment curves go up, and all the red negative sentiment lines go down.

And 90 percent or more of those excess returns appear to occur before the news event, to the detriment of hopeful, computer-news-driven investors.

More News, Better News, Broader News

There's been a furious technology race to improve the value of news: more and better news, with improved analytics and tagging. Media firms have made
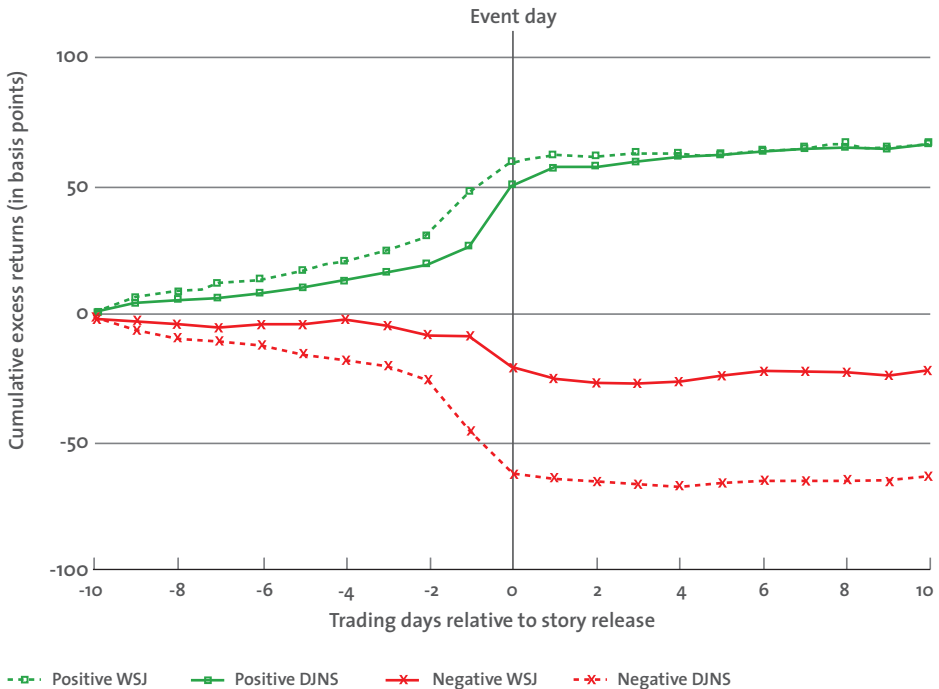
Source: Redrawn from Tetlock, et al, "More than Words, Quantifying Language...," *Journal of Finance*, June 2008

Long-Term News Event Study (1984-2004): *This figure is based on sentiment classification of* Dow Jones News Service Stories *(DJNS) and* Wall Street Journal *(WSJ) stories. Twenty years of news stories on S&P 500 firms were classified by sentiment. The event charts show the classifications are correct (on average), but that almost all the excess return* precedes *the news event. Modern methods improve this picture. See David J. Leinweber and Jacob Sisk,"Event Driven Trading and the 'New News,'"* Journal of Portfolio Management, *forthcoming Winter 2011.*

big changes in the volume, breadth and quality of the news on electronic feeds. Artificial intelligence and intelligence amplification (AI/IA) help people and machines work together, each playing to their own strengths. Ideas including visualization and close interfaces have assisted these improvements.

As described in my book *Nerds on Wall Street: Math, Machines and Wired Markets*, firms such as Thomson Reuters have created substantial new AI/IA news gathering organizations that combine

Media firms have made big changes in the volume, breadth and quality of the news on electronic feeds.

specialized Web crawler, extractor and classifer tools with wetware from humans. The effect is dramatic. A Thomson Reuters center in Mumbai quadrupled the number of stories about S&P Composite 1500 stocks to 21,000 per month over five years.

The organization also doubled the number of S&P Composite 1500 firms appearing on the feed. The market appears to be much less rapidly efficient about firms that are smaller, less followed, but still of investment quality and size. You and your computers are much more likely to find investable information about firms in the S&P 400 and S&P 600 small and midcap indices than about Google.

The aggregation of information coming from many sources can now take place at the rate those sources produce information, ranging from government and private research to social media. The human scale of the process gives investment horizons long enough to accumulate significant positions.

Language Technology, the CIA's Venture Capital
The Internet spawned a revolution in language technology—spiders, crawlers, scrapers, classifiers and translators—that is becoming pervasive. Mainstream vendors and open source communities continue to

refine sentiment, relevance, topic and other metadata.

U.S. intelligence agencies fund some cutting-edge research where the agencies have similar interests in related topics. The venture capital firm In-Q-Tel (www.iqt.org) lists about 25 investments in software, and the names alone suggest the richness of this area: Destineer, Language Weaver and Recorded Future. The AI/IA mix of human and machine skills moves forward at Palantir and others. Many of these firms extend into finance.

New Improved Investment Results
Dow Jones, Thomson Reuters and others have sponsored ongoing research and expert events for several years. I've been able to attend many of these (disclosure: performed research for Thomson Reuters) and have seen evidence for ideas of exploitable alpha from qualitative text and Web sources.

Many strategies disappoint because of their unprofitability or lack of breadth, for example. Others seem to have promise. One professor at an event started as a speaker, but switched to a guest, building

on his apparently healthy hedge fund performance.

Jacob Sisk and I earned our lunches and snacks at these events by simulating a pure news-driven stock portfolio. It produced gratifying double-digit positive results, was cross-validated by independent research at a major broker and, most importantly, produced true out-of-sample alpha when taken out of storage in late 2010 and fed updated unseen data.

We ran our first model from January 2006 to October 2009. It didn't add much value until a dramatic increase in 2007. One surprise was finding that Deutsche Bank's Quantitative Research group had simulated a portfolio with nearly identical returns as ours. But we could both be data miners.

A bigger surprise came in November 2010, when we revived the model and ran it on true, never-before-seen data—both prices and news. We found a true out-of-sample alpha better than 10 percent.

And What Would Watson Trade?

Progress in qualitative, relationship and text analytics is accelerated by close ties to progress in Web technologies. A further boost comes from the firms producing intelligence-driven technology, such as that sponsored by In-Q-Tel.

The impressive success of big data methods in language translation expands the possibilities for global investors at international firms. Watson reminds us that there are very innovative ways to combine ideas about how computers understand information.

Current media technologies are also impressive. They, too, will improve when combined with the wave of promising new methods.

There is great interest in exploiting qualitative information for investment and trading applications. If history repeats, expect high-frequency-trading-like speed wars between computers reading everything from Twitter to *Shanghai Daily*. ∎

Dr. David J. Leinweber, author of Nerds on Wall Street: Math, Machines and Wired Markets *(Wiley, 2009), is principal of Leinweber & Co. He serves as director of the nascent Center for Innovative Financial Technology at Lawrence Berkeley National Laboratory in Berkeley, California. His professional interests focus on how modern information technologies are best applied in trading and investing, and how technology affects global financial markets. As the founder and adviser to financial technology companies, and as a quantitative investment manager, he is an active participant in today's transformation of markets. Clients of his consulting and software business include some of the world's largest investment managers, hedge funds, brokers and exchanges.*

Staying Competitive in a Changing World

Services embedded in the network—or cloud computing—can build success by stretching resources, improving access to applications and protecting data.

The operating environment of many financial markets companies is filled with change and uncertainty in regulations, shifting economics and a continual and increasingly difficult search for alpha. At the same time, the complexity of the markets is increasing and the general level of reward is declining. How can companies stay competitive in these circumstances?

Infrastructure and Spending

The TowerGroup report *Securities and Capital Markets: Top 10 Technology Initiatives for 2011* by Stephen Bruel (December 20, 2010) presented a list of "must dos" for companies as they try to be competitive. These include improving data management, governance and analysis; upgrading valuations and analytics capabilities; managing collateral and counterparty risk and developing cross-asset-class trading and risk management. These improvements require additional resources for IT infrastructure, applications, and market and reference data. In addition, many processes will need to be renewed and upgraded as market structures change and as regulatory and reporting requirements become more onerous and time critical.

Peter Roe
Strategy and Market Insight Director—Global Banking and Financial Markets, BT Global Services

In the past, companies would have responded to these market and regulatory demands by spending more on servers, data feeds and new applications. These capital expenditures would have been echoed in increased IT personnel and real estate costs.

However, in the new reality, this process cannot continue to run its course. Many companies will need to fundamentally change their ambitions or their business models to continue to be successful.

Many companies will need to fundamentally change their ambitions or their business models to continue to be successful.

Cloud Services

One solution resides in the network. The financial markets sector is the most connected of communities: Companies have been electronically connected to venues and counterparties long before floor-based trading became a memory. As the connected community grew in number and geographical spread, companies embraced the concept of the extranet to save costs (with a total cost of ownership savings of up to 52 percent, according to *Managed Extranet Services Boost Performance and Lower Cost*, by Yankee Group and commissioned by BT) and become more agile as a result of a faster time to connect with new counterparties and customers.

With the rise of data volumes, extranet users gained substantial operational efficiencies by connecting with data aggregators and applications providers. For example, the BT Radianz–managed infrastructure supports a financial community of more than 14,000 customer locations and 400 application service providers.

The incremental extension of this business model provides a means for many companies to succeed and remain competitive in the next phase of the market's development. Network-delivered capabilities, called cloud services or cloud computing, provide ready access to an ever-greater range of services and access to additional compute and storage infrastructure in a secure and assured environment. Cloud computing does not require a revolutionary and risky leap into the unknown, but is a logical evolution of a well-understood way of doing business in the financial markets.

Value of the Network

For those connected to it, the network provides substantially increased value because it embeds

Cloud computing does not require a revolutionary and risky leap into the unknown.

- Helping established firms address opportunities in new markets and geographies
- Offering solutions to hedge funds and smaller firms emerging as a result of the changing market structure and regulations—potentially provided on a white-labeled basis by prime brokers

additional capabilities. For example, by including functionality such as security, authentication and identity management, the network, or "cloud," protects data and enables transactions to be carried out safely, securely and in compliance with regulatory rules and procedures.

The network, by providing data storage and access to solutions delivered as a service, will thus enable financial services companies in the following ways:

- Addressing the constraints of traditional in-house solutions, such as lack of agility and flexibility to handle changing business opportunities and threats, rigid commercial models, and siloed and obsolete solutions
- Consolidating gaps in business-to-business solutions, such as identity management and trust, through federated solutions
- Providing secure inter-business communications

As more capabilities move to the cloud, the greater the propensity of financial services companies and applications providers to use its scale-advantaged utilities. The cloud enables them to concentrate on those elements where they can add value, or to increase their agility because they can rely on tried and tested solutions that are accessible in scale anywhere in the world.

On the Network: How Companies Do Business
One example of embedding important capabilities into the network is a joint BT and

CEP is now used in many areas of the financial markets in data analysis, risk reporting and algorithm monitoring applications.

Sybase project now under way. These two companies are cooperating to develop a complex event processing (CEP)-as-a-service proposition. This solution would enable users to access the Aleri suite of CEP applications over the BT Radianz–managed infrastructure on a pay-as-you-go basis, and users could access additional infrastructure to support fluctuating processing loads.

CEP is now used in many areas of the financial markets in data analysis, risk reporting and algorithm monitoring applications. Access to state-of-the-art CEP capability through a flexible, assured and operating expense-based delivery model will be an important component of ensuring success in this changing world. ◾

Peter Roe is the director responsible for strategy and market insight in the part of BT Global Services that serves customers in the global banking and financial markets. He joined BT in 1999, after spending 20 years as an investment analyst focused on companies in the technology and telecom sectors. Before BT, he served as director of U.K. and European equities at Nikko Europe and led the telecoms sector research team at Paribas Capital Markets. He gained his degree in engineering production and economics from the University of Birmingham in 1978.

Harness the Power of In-Database Analytics

Performing certain calculations in-database can bring gains in functionality and efficiency.

A database in general is a wonderful piece of machinery for dealing with large data volumes. But when dealing with the immense data sets found in the financial industry, a highly optimized column-based analytics database server provides superior query performance.

Analytics capabilities built into the database—impressive and useful on their own—are often used with external analysis software to provide the quick and responsive analytics end users expect.

External analytical functions normally interface with the database through a client/server approach. The database transfers data to the calculating client, which performs the necessary calculations before presenting the result to the end user and/or writing it back into the database.

Separating the duties of the database from those of the client in this way is a simple yet powerful model that has worked well for the last 30 years or so.

But do you sometimes wish you could reach into the database and perform your own calculations as efficiently as if they were built-in? That is exactly what the technology of in-database analytics

Niclas Holm
CEO and Co-founder, Algorithmica Research

allows you to do. Simply move your calculation code to the database server and embed your advanced quantitative analytics inside the database.

Areas of Use

A logical assumption might be that any function using a lot of data fetched from the database would benefit from implementation inside the database, in whole or in part. But the best candidates for in-database implementation probably perform a data-heavy function that is generally used within your organization. Here are a few examples from different areas of quantitative finance:

- **Risk management:** Implementing Monte Carlo–based calculation of potential future exposure (PFE)/credit valuation adjustment (CVA) (in parts)
- **Derivative pricing:** Modeling volatility surfaces (SABR model, etc.)
- **Algorithmic trading:** Calculating custom trading algorithms (for post-/pre-trade)
- **Point-in-time recovery:** Re-creating order books at a point in time

Benefits of Performing Calculations In-Database

Implementing functions as in-database analytics lets them perform calculations inside the database itself in a highly optimized manner. This avoids unnecessary communication between the database and the calculating client, resulting in huge performance gains.

But the benefits don't stop at performance gains. Perhaps an even more important advantage is that the functionality becomes available through normal database queries. Thus, in-database analytics is a quick and cost-efficient way to support existing query tools with new analytical possibilities—and without expensive upgrades or rewrites.

You can implement this either by yourself in C/C++ or by using an external supplier's ready-made solution. If you have already written your analytics in C/C++, it is relatively straightforward to adapt it for running within the database. Just make sure your code is stable and without any hard errors, which can otherwise harm the integrity of the database server.

For this reason in particular, an easier way might be to look at available external analytics software. These already contain the needed functionality and install in the database within minutes.

Taking It One Step Further

As useful as this technique already is, it's only the beginning. In the near future, interesting things will happen with complex event processing (CEP) solutions and databases sharing more and more of the same infrastructure, including in-database analytics. With enhanced functionality such as making the library of financial functions and powerful object-oriented language available inside the database, quantitative developers can implement functionality in the database using an environment more productive than C/C++ and still gain the benefits of faster execution time and wider availability. ■

Niclas Holm is CEO and co-founder of Algorithmica Research—a provider of solutions for quantitative financial analysis, including the award-winning Quantlab suite and the ARMS truly programmable risk management system.

Analytics R Us

As data sets grow larger and corporate challenges for speed increase, traditional data analytics software packages fail to meet user demands.

As enterprises face the increasing pressures of shrinking margins, greater competition and regulatory demands, the need to make the best use of data becomes more acute. Data mining—the extraction of vital information from data warehouses to predict trends and behaviors, find hidden patterns and answer business questions—has raised the stakes for data analytics software. At one time, most data analytics software was designed by computer scientists. Often, statisticians, engineers, scientists and students without computer programming skills found it difficult to use.

Now, low-cost, high-quality, real-time data analytics is available in R, an open source programming language and software environment for statistical computing and graphics. Because R is an open source project, a worldwide community of active developers works to improve, maintain and support it. Like Linux, the most famous open source project, R isn't "owned" by any single person or entity. Best of all, for the many corporate and academic data analysts, R is free to use and modify.

Beyond its cost and convenience, R has gained acceptance rapidly because data analysts can adapt it by writing variations for specific tasks. For example, there are dozens of packages for derivatives analysis alone.

David Champagne
CTO,
Revolution Analytics

Analytics R Changing

R represents a radically different approach to the challenges posed by analyzing increasingly large and complex data sets. Because it takes so long for traditional software vendors to update and modify their products, a new generation of analytics written in R has arisen to fill the vacuum.

For example, when a large investment bank sees an opportunity to gain a competitive advantage by offering a new product, it can't afford to wait for one of the traditional vendors to develop the newer analytics techniques required to model and price these increasingly complex instruments. Instead, the bank will likely

R represents a radically different approach to the challenges posed by analyzing increasingly large and complex data sets.

assign the project to its own quantitative analytics group or perhaps outsource it to one of the hundreds of small development firms springing up to take advantage of the growing demand for newer, faster, less costly and more powerful analytics tools. No matter who does the coding, the new program is likely to be written in R, since R has become the lingua franca of statistical analysis.

Until recently, the lag time between modeling big data and deploying advanced analytics models based on it was measured in months or even years. There was simply no fast and easy way to move from the mining/modeling stage to the deployment/execution stage. But now, open source

players are established at every layer: from data storage, to extract, transform and load (ETL), to predictive analytics, to deployment and presentation. Together, these components represent an "open analytics" stack: a collection of low-cost yet flexible and sophisticated tools for handling large data sets. The emergence of this technology stack is a sure sign that open source platforms are assuming more prominent roles in the expanding universe of terabyte-class analytics.

Data R Growing

The timing could not be better. The convergence of mobile, social and cloud computing has resulted in a deluge of data, most of which is unstructured. Consider: Wal-Mart processes 1 million transactions per hour, and the New York

In the time that it takes traditional software vendors to develop, test and release new products, the world will have changed again. The new generation of open source analytics programs, based on open source programming languages such as R, represents a more likely solution to our common data dilemmas. ■

Stock Exchange generates 1 terabyte of new trading data daily. Cisco, in its *Visual Networking Index: Forecast and Methodology, 2009–2014*, projects that over the next three years, global Internet traffic will more than quadruple to 767 exabytes. By 2014, the report forecasts that nearly 90 percent of the world's IP traffic will be generated by consumers, creating an immense new universe of data that can be converted into highly valuable—and actionable—information and insight.

   When firms face this abundant data, traditional analytics software is not the answer.

David Champagne is a provider of software and support for the popular open source R statistics language, and a software architect, programmer and product manager with more than 20 years of experience in enterprise and Web application development. As principal architect/engineer for SPSS, Champagne led the development teams and created and led the text mining architecture team.

Market Data Opportunities in 2011

Technical innovation, competitive products and traditional market data suppliers will make a good year for data acquisition and dissemination.

Market data managers face demands from all over the firm. Risk managers want historical data to run their simulations. Traders want the fastest data they can find—and more of it—thanks to the near ubiquitous move to multiasset and global strategies. Market fragmentation continues to drive the demand for more sources, regardless of asset class or geographic coverage. And derivatives instruments are moving to exchanges, creating even more demand for market data integration, consumption and storage.

Do these demands lead to robust budgets and rock star status? Umm… No.

For three consecutive years, CIOs have ranked market data terminals as the first area targeted for cost reduction in Aite Group's annual capital markets technology spending report. High-frequency trading accounts for more than two-thirds of trade executions in the United States, and Aite Group estimates it will account for 40 percent of trade executions in Europe by 2012.

In the Aite Group report *2011 Capital Markets Technology Spending: Risk, Compliance, and Uncertainty Abound*, market data managers also identified cost

Adam Honoré
Research Director,
Aite Group

reduction as their top business priority in 2011, but they are at odds with CIOs over managing the electronic trading side of the business. Improving the architecture for best execution is the second priority for market data managers, and improving scalability to cope with increasing volumes is fourth. Conversely, market data feed handlers and ticker plants do not crack the top 15 priorities of capital markets CIOs in 2011.

Market data firms do not plan to make technical investments in 2011, despite recent innovations. Many of the core technologies driving an effective market data

Business objectives in order of priority related to IT spending (n=20)

Business objective	1	2	3	4	5
Business agility	35%	10%	10%	15%	10%
Operational efficiency	29%	19%	33%	10%	<10%
Compliance	25%	10%	15%		30%
Risk management	<10%	20%	15%	35%	10%
Growth	10%	24%	10%	14%	10%
Reducing cost	<10%	14%	14%		14%
Organizational integration	<10%	10%	<10%	15%	20%
Latency reduction	<10%	<10%	11%		
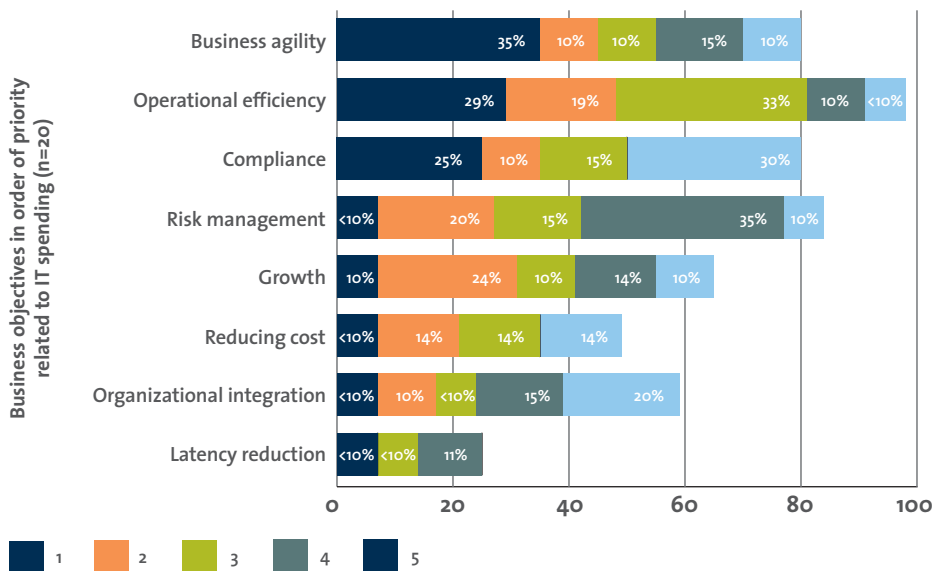
Source: Aite Group

Ranking Business Priorities: *Business agility, operational efficiency and compliance top the list of business objectives for which capital market firms will invest in IT.*

platform rank near the bottom of infrastructure spending. Nearly half of CIOs indicated there was no chance they would invest in hardware accelerated devices, which have become the new standard for market data feed handlers. Another quarter of CIOs indicated there was no chance of them investing in low-latency middleware, which is essential for effective market data fan-out.

Exchanges Poised for Data Gains

The winners in 2011 for market data will be the exchanges. Leveraging existing vendors to serve more internal needs is the number three business priority for market data professionals. This sounds good for market data firms such as Thomson Reuters and Bloomberg.

Still, the top cost-reduction area involves eliminating duplicate data. If a bank receives direct feeds for algorithm trading, will it begin pushing exchanges to supply more of their market data? Further, customers will demand more from exchange data products as exchanges continue to supply more technology, including co-location.

The consolidation of exchanges may accelerate market data dissemination as a revenue

priority while exchanges seek to add value to shareholders through these mergers. And mergers could drive interesting products into the markets.

For instance, Deutsche Börse owns a low-latency economic indicators supply. If the acquisition of NYSE Euronext is successful, that service will be offered in NYSE Euronext data centers. NASDAQ OMX has successfully moved into the trading risk technology space and could easily expand its market data portfolio with value-added services.

Data Strategies for 2011

CIOs may need to move market data infrastructure further up on their list of investment priorities in 2011 to support growing demand. Further, technologists may find themselves upgrading product and entity data supply systems in response to the resurgence of reference data demand. As unstructured data such as low-latency news feeds penetrate more trading and risk infrastructures, technologists may soon find that the defini- tion of market data continues to grow along with volume— and that expansion will also need to be supported by the different systems.

The winners in 2011 for market data will be the exchanges.

To compete with an emerging exchange business, traditional data suppliers must create innovative value-additions for data products. Historical data as a service comes to mind. Exchanges are well aware that their listings and equity transactions businesses are not good long-term bets.

For emerging exchanges, start by saving data. Save all of it. Historical data is a money maker for an exchange when the market becomes attractive to foreign investment.

Finally, to market data managers: Document the demand, deliver the results and then demand the raise. With technology innovation, competitive products through exchanges, traditional market data suppliers and upstarts supplying data to low-latency traders, 2011 is a good year for options in market data acquisition and dissemination. ■

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In Europe, cross-market competition makes technology upgrades critical to survival.

The Technology Imperative

Competition through evolution is the name of the game in the capital markets universe. Modern advanced trading techniques have been the state-of-the-art sporting equipment, providing a competitive advantage in the contest of finance. The equipment race is changing dramatically, and nowhere are the stakes higher than in Europe.

Deregulation started in the U.S. in 1998 and quickly jumped the Atlantic, making it possible for firms to trade across markets. As a result, many firms actively seek trading advantages in alternative markets. The close proximity of many smaller markets with long overlaps in trading hours makes Europe a natural fit for intense cross-market competition by big firms, but leaves smaller local firms vulnerable.

The stronger financial areas of London, Frankfurt and Paris are highly motivated to stay on top of competitive strategies, but plenty of smaller markets still may consider tried-and-true techniques to be good enough. Falling behind in

Eric Johnson
Senior Vice President
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The equipment race is changing dramatically, and nowhere are the stakes higher than in Europe.

the technology race could mean elimination by a large competitor. Thanks to intensifying market competition, European capital markets firms may face more of a collapse than an expansion over the next decade.

Empowering the Front Office

Most firms know that times are changing. But they face a significant uphill battle against a massive spaghetti bowl of information systems that has tangled and evolved over 30 years.

Protectionist and cultural hurdles prevent key stakeholders from thinking outside the box. For many, the first line of defense is to create ad hoc extensions to an existing system. However, many stakeholders don't consider how long these extensions will serve the needs of the business—assuming they are still useful by the time they are delivered.

Firms that are willing to disrupt the status quo to truly meet the needs of the business today and beyond will become far more agile and far less vulnerable than those only willing to polish existing systems. But even for those firms ready to embrace new ideas, executing on those ideas can be an inefficient and error-prone process.

Front-office staff traditionally use a mishmash of tools to do their jobs, including spreadsheets, in-house applications and memorization. Opportunities to improve the process of extracting reliable intelligence from these multiple sources of data are not difficult to conceive. But updating front-office software tools requires a long, back-and-forth exchange with back-office developers. And miscommunication frequently hampers that process.

Evidence of the industry's acute lack of real-time market intelligence abounds in 2011.

Worse, results often come too late to make a real impact. The market may move in a different direction or competitors may beat them to the punch, eroding the value of the opportunity. Organizations everywhere—but particularly in Europe—need an end run around the traditional back-office development process.

Newer technologies make it possible for front-office traders to interact in new ways with the systems that assess risk or monitor trading strategy effectiveness. They can build precisely the views that they need on the fly, without invoking a complex and costly development process. The front office can directly implement its business differentiation in a fast and robust way.

One example of an exceedingly useful and potentially profitable capability is the use of a single tool to develop a new model, deploy it and then view the performance of the new strategy alongside existing ones, using both historical data and real-time data in one place. This approach is particularly valuable when those strategies can be quickly updated, enhanced or swapped in and out according to market conditions.

Sadly, the systems that today's front-office traders rely upon can't do this. Waiting weeks or months for developers to make it happen is excruciating, especially when the life span of the new trading strategy may be shorter than the development cycle.

Tying Risk and Reward
Evidence of the industry's acute lack of

real-time market intelligence abounds in 2011. The global credit crisis—and the trillions of dollars in stimulus spending and bailouts that resulted from it—poignantly show that those who do not have the means to monitor performance

Present-day data monitoring techniques, which capture and copy large data sets from production to a local environment, create out-of-sync

> *[Companies] have plenty of good data, but it's in too many places and lacks a facility to merge and draw inference.*

data and multiply the data management burden. It takes about 1,000 times more energy, which is the lion's share of today's supercomputing costs, to move a data byte than it does to do a computation with it in situ, according to a 2010 article by the BBC. Modern technologies capable of in situ data analysis promise lower expense, faster results and a low margin of error.

and movement in a very transparent, easily accessible way will ultimately fail.

It's not because companies have bad data. They have plenty of good data, but it's in too many places and lacks a facility to merge and draw inference. This situation prevents companies from making accurate decisions and costs them a lot of time.

Finally, consolidated views of trade and risk data can elevate business performance in more tangible ways. A firm that can identify new areas of

Consolidated views of trade and risk data can elevate business performance in more tangible ways.

opportunity without enduring unnecessary risk is one that can easily justify the budget to develop more advanced trading strategies. And that will lead to higher investor returns and revenue.

One clear, transparent view of organizational data will open the door not only to risk avoidance but also to incremental revenue and, ultimately, a strong defense against the rigors of cross-market competition. ▪

While currently responsible for leading the company's North American operations, during his tenure at Sybase Eric Johnson has held several positions, including senior vice president and general manager for Europe, Middle East and Africa (EMEA) for financial services, as well as directing financial services accounts for the Central European region of Sybase. Before coming to Sybase, he was at WebMethods as director of sales for financial services and served as vice president of sales of North America for Aleri. Johnson began his professional career as a yen options trader at the Mercantile Exchange in Chicago and earned his Bachelor of Arts degree from the University of Wisconsin, majoring in political science and economics.

Down Under Looks Up

Australia has responded to the challenges of the global financial crisis of 2008. The post-GFC world is certainly different, but the banking industry and the country remain resilient and well placed.

Banking has changed in Australia since the global financial crisis (GFC) of 2008. There is a heightened awareness of risk, underlined by new and proposed regulation that has resulted in changes to how derivatives, collateral and liquidity are managed.

Mike Stockley
Executive General Manager Business Operations, Wholesale Banking, National Australia Bank

Managing Collateral

The GFC forced additional focus on collateral. Failures in U.S. and Icelandic banks highlighted weaknesses in collateral management practices and demonstrated that some underlying assumptions were unreliable in stressed situations. These included assumptions on the timing of the receipt of payments and the independence of counterparty default probabilities and currency movements.

Collateral as a means of managing risk between counterparties is a well-established market practice. Over time, in a world of stability and competition, some banks had been less than rigorous in the way in which they valued derivatives and managed collateral through the lens of counterparty default. There are examples of banks agreeing to one-way collateral—that is, one party might be protected, but the other wouldn't. Operationally, where a collateral valuation difference occurred between banks, agreeing on the quantum of the difference was more important than settling an approximate amount quickly. In a stable world these practices were not seen as problematic, but when the GFC hit and sensitivity to creditworthiness became heightened, the weaknesses and gaps in historic practice became evident.

Australia has a structural current account deficit, which means there are insufficient sources of liquidity within Australia to completely fund bank assets. Lending is dominated by

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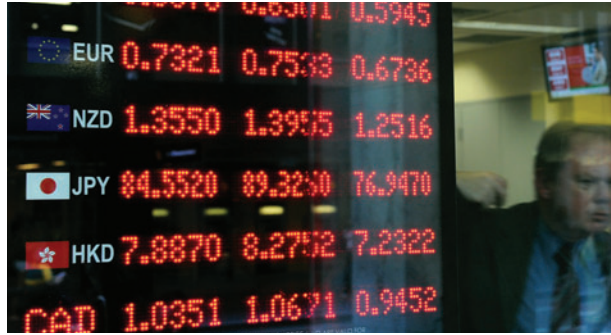
four major banks, all of which have AA ratings. Australian banks and, indeed, corporates, carry out a significant amount of offshore borrowing. These loans are often hedged with cross-currency swaps and can be concentrated into exposures with a few large international investment banks. Collateral arrangements mitigate the counterparty risks.

Credit exposures to currency movements are large, and the associated "wrong way risk" was highlighted when the Australian dollar fell significantly in the days following the failure of a large U.S. investment bank in late 2008. The failure contributed to the Australian dollar drop, and Australian banks' credit exposures increased at the very time the default occurred. This experience also highlighted the critical importance of robust operational

procedures: to be able to call events of default quickly and collect collateral in a timely manner.

The financial community has sharpened its risk mitigation practices—examples include tightening the management of operational procedures and having a much higher awareness of the type and quality of collateral being posted. The type of collateral that's acceptable, and its valuation, is under greater scrutiny (hint: people like cash); multicurrency collateral adds a further dimension to this.

Managing Counterparty Credit Risk

Another evolution in counterparty risk is the more widespread adoption of credit valuation adjustments (CVA) in derivatives pricing and risk management. CVA is the difference in a derivative's value, taking into account the possibility of a counterparty's default. Accounting regulations have required CVA to be recognized at a portfolio level for some time, but the industry has been at varying levels of maturity in terms of the ability to calculate CVA on a trade-by-trade basis and dynamically manage the risk in near real time.

One approach to managing the counterparty default risk in the portfolio is to collate these credit

Australian banks are working with industry bodies to understand and respond to the emerging issues around CCPs.

risks and manage them on a centralized basis, just as banks' central treasuries have historically managed liquidity risk. Centralizing risk has its own risk issues, however, and to manage at the portfolio level, all the deals with a specific counterparty must be evaluated. The amount by which this exposure changes as market rates move and as the creditworthiness of the counterparty changes is a fiendishly complex problem—and that is before any attempt to hedge it. Added to that is the need to think about what collateral is held to offset the risk and how its own value is changing (if it isn't in the same currency as the exposure), how often the collateral is adjusted and the time delay in receiving or paying the collateral. The list goes on.... The issue is easy to identify; it's the management that gets complicated.

One proposed mechanism to help manage counterparty risk is the use of central clearing parties (CCP). The view is that CCP mitigates counterparty risk arising from many bilateral trades by forming points where collateral is cleared. Others contend that point-to-point collateral arrangements may be no more or less risky than smaller amounts of concentrated arrangements. If one counterparty fails, the overall system is resilient. Unless, of course, the counterparty that fails is the CCP itself. If a failure occurs, the impact would be severe and the consequences difficult to predict, particularly in the current environment, where the political appetite for liquidity support for a failed institution is likely to be low.

Australian banks are working with industry bodies to understand and respond to the emerging issues around CCPs.

The Issue of Liquidity

The causes of the GFC were many and varied, but the crisis manifested itself from an Australian perspective as a liquidity issue in the weeks after the collapse of Bear Stearns and Lehman Brothers.

Although the securitization and packaging of loans sold to third-party investors was occurring in Australia before 2008, the practice was not as widespread as it was in the U.S. Lending on a "low doc" basis with high loan-to-valuation ratios was also not common practice. As a result, the Australian banks and investors did not have anything like the balance sheet problems of the banking industries in other countries.

The GFC showed that the risk issues in the derivatives world were small compared to the issues

in the "real" world of physical assets and liquidity. As noted, the Australian banking industry relies heavily on offshore funding, and thus Australia was directly impacted. The government's response was to guarantee banks, allowing them to continue to borrow and giving them time to adjust their liability profiles. After 2008, the regulatory response to the liquidity problem is to require banks to hold more liquidity—something that Basel II had not addressed.

Clearly, regulators desire that banks hold liquid assets—the challenge of the Australian experience has been that a healthy economy and small fiscal deficit has meant that the supply of liquid assets (essentially government and quasi-government debt) is too small for the regulatory demand. There is also the unresolved question of the need to balance liquidity against the capacity of the banks to lend to industry, enabling the economy to grow.

As a result of the GFC, the broad thrust of the response is that there will be a general uplift in the capital required to underpin derivatives portfolios, improved operational risk management practices, much clearer understanding of the need to price for counterparty risk and better and more prudent management of liquidity.

The Outlook

Australia has come through the GFC in better shape than most economies. The banking industry in Australia did not have the leverage and balance sheet exposures that firms in countries such as the U.S., the U.K. and Ireland had. Because of Australia's low debt, Australia was able to implement a stimulus package it could afford. Continued strong demand for commodities, at high prices, has helped the economy recover quickly. And with slow but steady improvement in liquidity conditions, albeit at wider margins, funding is not the issue it was.

Unemployment stands at 5 percent, the Australian dollar is at parity with the U.S. dollar and the four major banks in Australia are well capitalized, profitable and maintain AA credit ratings. ■

After six years as a practicing civil engineer, Mike Stockley worked in and around dealing rooms for more than 20 years, running an interest rate derivatives trading desk for a major Australasian bank. Stockley joined National Australia Bank (NAB) in 2008 as general manager market risk, responsible for risk management for all NAB's traded markets businesses, before starting as the executive general manager business operations, wholesale banking. Stockley is responsible for all business operations and services across wholesale banking, including technology, global operations, global business management, project services and business and data architecture, as well as services in the U.K. and U.S.

Tokyo's Leap into a New Era

The world's second-largest stock exchange spent the last decade falling behind. Its recent rally is impressive, but it may be too little, too late.

Tokyo may be one of the high-tech capitals of the world, but in the heart of its financial district, Kabutocho, tradition reigned. And not in a good way: Despite switching to all-electronic trading in 1999, the Tokyo Stock Exchange (TSE) found itself leapfrogged by competitors throughout the 2000s.

David Parker
Director of Global Financial Services Solutions, Sybase, an SAP Company

Striving to overcome years of malaise, TSE kicked off 2010 with a bang, launching its long-awaited Arrowhead trading system in January. This next-generation system combines low latency and scalability. Order confirmation time has dropped from seconds to three-thousandths of a second (0.003 seconds).

And Arrowhead constantly scales, ensuring that it has twice the processing capacity required at any given time. All this to avoid embarrassing and revenue-sapping downtime.

Concurrent with Arrowhead's launch, TSE also revised its trading rules, created co-located sites to make trading more convenient for investors, and made market data available more widely and quickly. For instance, in February 2011, TSE launched a new high-speed index service that disseminates new and

recalculated price indexes within 10 milliseconds, a hundredfold decrease in latency.

Those technical improvements have helped Arrowhead lure more high-frequency traders. By August 2010, high-frequency trading constituted about a third of all trades. That's two to three times more than at the start of the year—and approaching the ratios of Western exchanges.

Challengers, Foreign and Domestic

Despite these technical improvements, TSE's trading volume fell 5.3 percent to

TSE kicked off 2010 with a bang, launching its long-awaited Arrowhead trading system in January.

US$4.25 trillion in 2010 from US$4.48 trillion in 2009.

The reason? Domestic challengers, in the form of proprietary trading systems.

A securities firm creates a proprietary trading system to allow investors to trade stocks and bonds electronically without stock exchanges—day or night. They are similar to multilateral trading facilities (MTFs) in Europe and alternative trading systems such as electronic communication networks (ECNs) in the United States.

Proprietary trading systems were in Japan before 2010, such as SBI Japannext and Kabu.com. But the launch of Chi-X Japan in July 2010 ushered in a new era in market competition.

Chi-X advertises lower trade latency technology than competitors, as well as low cost and high transparency.

Overall proprietary trading system volumes remain small and were just 1.4 percent of trading volume in Japan in 2010. But they are set to grow fast. SBI Japannext saw its monthly trade turnover triple from January to December 2010. Meanwhile, Chi-X's January 2011 trading turnover of US$3.44 billion was 58 percent higher than its entire volume for the second half of 2010.

Besides domestic challengers, TSE faced setbacks overseas. As stock markets across the globe began to seek long-term partners, TSE found itself spurned by the Singapore Exchange (SGX). Despite being owned 5 percent by TSE since 2007, SGX turned its eyes southward and instead offered to merge with the Australian Securities Exchange (ASX) Ltd.

Earthquake Aftershocks on the Japanese Economy

Shadows of March 11's natural disaster will hang over every Japanese business—and many businesses abroad—for the rest of 2011. The calamity exposed the world's dependence on the Japanese auto and tech industries, as well as the fragility of the supply chains connecting them.

The Tokyo Stock Exchange's (TSE) index fell 18 percent in the week after the disaster, but it gained back half of that ground in a week. And the new Arrowhead system and co-located servers overcame huge volumes and volatility spikes to prevent trading interruptions on the TSE.

Meanwhile, prices in the world's third-largest economy continue their rise due to supply-and-demand issues with domestic and commercial products. These issues will exacerbate stock market volatility, as will Japan's continuing struggle to repair its damaged nuclear reactors.

Despite production delays and shut-downs, the International Monetary Fund predicts Japan's 2011 gross domestic product (GDP) growth will fall only to 1.4 percent from 1.6 percent, according to a forecast weeks after the disaster. Leading firms, such as Toyota and Honda, mirror that expectation, predicting that factory shutdowns will trim only 1 to 2 percent off their total 2011 output.

The tens of trillions in yen (hundreds of billions in U.S. dollars) needed to rebuild infrastructure, housing and the like would ultimately stimulate the depressed construction sector and create new jobs. Political parties are already canvassing the incumbent government to invest in the ailing economy.

Moreover, low interest rates are helping to finance the numerous necessary rebuilding projects. These projects could actually give the Japanese economy a short-term boost, helping to lift it from decades of stagnation, at least temporarily.

There is precedent for this optimism. Rebuilding after the 1995 Kobe earth-quake and fire also jump-started the Japanese economy.

The new Japanese infrastructure will be more modern and efficient than what existed before the 2011 earthquake. Having advanced technology will help Japanese businesses leapfrog the infrastructure of companies in other nations and will aid multiple market sectors—which will surely help encourage recovery.

Not completed as of early March 2011, the marriage of SGX and ASX would be a marriage of technical leaders. ASX launched a trading platform, the Genium INET, which cut its average trade time to 250 microseconds (millionths of seconds). That is expected to be topped by SGX's Reach system when it launches in late summer 2011.

The marriage of SGX and ASX would be a marriage of technical leaders.

Challenges to TSE and Proprietary Trading Systems

It's difficult to predict the future of stock trading in Japan. Proprietary trading systems such as Chi-X have tremendous momentum. But TSE has a long-standing near-monopoly. Challengers such as the Osaka Exchange, which holds less than 5 percent market share, must climb a veritable Mt. Fuji before they can be deemed true rivals to TSE.

Moreover, Arrowhead has rectified the technical sins of its predecessors. It has brought TSE to parity with its global peers, at least for now.

TSE's true challengers, thus, may lie overseas, as stock market competition evolves beyond national boundaries into an international struggle. Mega-mergers, such as the Deutsche Börse with NYSE Euronext or the London Stock Exchange with Canada's TMX, would accelerate TSE's ongoing slippage from its 1990 peak, when its listed companies constituted 60 percent of the world's total market capitalization.

Having belatedly made the technical leap forward, TSE may find itself forced to jump into the merger game it for now eschews. ∎

David Parker is a seasoned IT professional who has worked for more than 25 years within the banking and finance industry, covering both business and technical areas. Parker spent most of his career working in London, starting as a computer operator for the University of London (UCL). He later held several key positions with Bankers Automated Clearing Services (BACS) as a senior business analyst within its banking division, providing architectural solutions to BACS institutional clients. He then moved into a consultant role for Flexi International as a managing consultant. In early 2000, Parker joined the management team of Aleri to drive forward its CEP product into fresh new markets domestically, until Aleri was acquired by Sybase.

Asia-Pacific's Next Big Player

High-frequency trading has changed the game in Asia-Pacific, and Beijing's dream to make Shanghai a top financial center will require besting another Chinese center.

Beijing has a goal: Make Shanghai one of the top three world financial centers by 2020.

Shanghai has a ways to go before standing tall amongst London and New York. Yet it is the home of 19 million people and host to the world's seventh-largest stock market, with a market capitalization of US$2.7 trillion as of December 2010. And thousands of mainland firms are lining up to list on it.

Can Shanghai meet Beijing's goal? It's not out of the question.

One big advantage is, simply, being in Asia. Capital markets in Asia-Pacific will grow faster than in any other region over the next few decades, according to research and advisory firm TowerGroup. Moreover, IT spending among capital markets firms in China will be double that in Europe and North America over the next few years, predicts Celent, a financial strategy consultancy. In fact, Celent found that IT spending for retail, insurance and capital markets in Asia-Pacific will grow at 6.2 percent to reach $108.2 billion by 2013.

Neil McGovern
Director of Financial Services Product Management, Sybase, an SAP Company

High-Frequency Trading as a Leading Indicator

Chinese capital markets firms will spend most of their budgets on advanced trading systems, such as those for high-frequency trading. The fact that high-frequency trading has changed the market landscape in New York and London has not gone unnoticed in Asia-Pacific. Beijing is eager to keep pace with other capital markets firms around the globe.

Because high-frequency trading already dominates equities and other asset class markets in North America and

Europe, advanced information technologies are routinely found there among trading firms and exchanges. Market-friendly regulations have also helped drive high-frequency trading and related technologies in these regions.

Sybase conducted a simple research study to evaluate the current opportunity for high-frequency trading in key regional markets. This research focused on three factors:

- **Market environment:** Average latency, rate of automation for trades, competitive pressures driving innovation, cultural openness to change

- **Regulatory forces:** Acceptance of alternative trading systems, best execution regulations, limited trading restrictions

- **Technology enablers:** Innovation in trading infrastructure, efficient exchange and clearing mechanisms, trading capacity of internal trading systems

The following table describes the results of this research.

What's happening in Shanghai is happening across Asia-Pacific. Most spending in the region is focused on upgrading systems to increase capacity, enhancing risk management and adopting new trading practices, such as direct market access trading and algorithmic trading. While Tokyo and Hong Kong—the region's traditional financial centers—are leading, newcomers, such as Singapore and Australia, intend to catch up and dominate.

High-volume trading is a competition that is heating up across the region, and it is driving

	Singapore	Japan	Australia	Hong Kong	India	Taiwan	China
Market	4.8	4.3	4.2	4.8	4.4	2.4	2.2
Regulation	7.9	7.8	8.6	9.1	3.1	6.0	1.4
Technology	9.6	7.7	9.2	6.8	5.8	3.4	1.5

Source: Haas School of Business, University of California at Berkeley, commissioned by Sybase, an SAP Company

Rapidly Adopting High-Frequency Trading Techniques in Asia-Pacific: Researchers collected data on more than 30 metrics about market environment, regulations and technology for the countries listed. Data indicates that Japan, Australia and Singapore are most likely to rapidly adopt algorithmic and other data-intensive electronic trading in the next one to three years.

Celent found that IT spending for retail, insurance and capital markets in Asia-Pacific will grow at 6.2 percent to reach $108.2 billion by 2013.

spending ever higher as exchanges, local institutions and even governments try to increase their market share at others' expense.

Shanghai vs. Hong Kong

Shanghai will have competition for a top spot in Asia-Pacific. Singapore may be a relatively small player in world markets today, but it has potential for dramatic growth. Low government interference has led some experts to infer a coordinated effort between the government and the financial services industry to promote Singapore to the top echelons of the global finance community. However, the Singapore Stock Exchange has done its part as well, investing in low-latency technologies and aiming for sub-millisecond latency in 2011.

Gamblers betting on which Asian city would host a regional financial powerhouse of the future once might have put Hong Kong at the top of their lists. Its history and its access to the vibrant Chinese markets would make it a safe bet as the outright leader.

However, a combination of aggressive moves by other players and a lack of vision and execution by Hong Kong's financial and governmental agencies could result in Hong Kong's slip from regional leadership. Critics see Hong Kong's government as China focused, rather than regionally focused, like Singapore's government.

The local situation is still very profitable for Hong Kong. There are regular high-margin Chinese initial public offerings (IPOs). Its exchange favors brokers over customers and thus gets

blamed for high spreads. The local stamp duty adds more revenues to the locality, and the cost burdens are passed on to the customer.

As liquidity increases in the region, Hong Kong might appear to be focused on the short term. But if anything is a threat to the dominance of Hong Kong, it might be Beijing's goal of raising the global stakes in Shanghai.

Small Adjustments in Japan

In Japan, high-frequency trading accounts for 10 to 15 percent of equity trading volume, with an average trade size of approximately $6,900, which is low for the region. But price pressure based on high-frequency trading proliferation should continue to push this number lower. The average trade size in New York dropped from around $1,500 to about $200 in the 10 years following the introduction of electronic trading.

Far more than average trade size is changing in Tokyo. In 2010 the Tokyo Stock Exchange (TSE) launched Arrowhead, a new trading platform that dramatically reduced latency. But a change in clearing rules allowed the Japan Securities Clearing Corporation

Shanghai will have competition for a top spot in Asia-Pacific.

(JSCC) to clear trades from alternative trading venues. This opened the market to proprietary trading systems, such as Japannext. These paved the way for the launch of Chi-X Japan, which has now garnered more than 5 percent of the volume of Japan's most liquid stocks. Clearly, even Tokyo is not immune to the fast-paced changes that buffer Asia-Pacific as it embraces high-frequency trading.

Enjoying the Show

Asia-Pacific is one of the most interesting regions in the world for financial services—at least from a spectator's standpoint. As regional exchanges transform to a global focus, watch for a dramatic rise in regional volume, more aggressive trading practices and leading IT systems to manage it all. ■

Neil McGovern has more than 20 years' experience in the software industry as a senior executive at several successful companies. McGovern focuses on high-performance analytics for risk, trading and compliance for Sybase's financial services team, and he has presented at conferences around the world on the latest trends and technologies required for cutting-edge performance in capital markets. Prior to Sybase, McGovern was vice president of engineering at New Era of Networks and chief technology officer of Convoy Corporation, where he was a pioneer in the enterprise application integration market.

Seeking the Higher Ground

Inflationary pressure around the world will prompt central banks to raise rates. When the inevitable happens, investors will need to be fast on their feet.

"Don't fight the Fed."

That hoary Wall Street maxim has served investors for decades—and, more than likely, will come in handy again soon. As inflationary pressures bubble around the world, the Chinese central bank already has ratcheted interest rates tighter. In an interlocked global economy, inflation is not likely to stay sequestered on one side of the Pacific.

Some forward-looking investors already feel the screws tightening. Under one scenario, the U.S. Federal Reserve Board turns away from quantitative easing and shortly thereafter reverses its easy-money policies. The Fed, however, does not turn on a dime. Before the Fed changes course, increases in commodity prices likely will need to percolate through the economy and begin to pinch consumers. The Fed also would be negotiating some tricky political terrain. Unemployment that stubbornly remains around 9 percent makes a strong argument against slamming on the interest-rate brakes.

A Risky Environment

Barring calamity, global economies sooner or later will begin to overheat, triggering a central bank response. That kind of environment creates an environment fraught with risk for investors. Stocks and bonds in general, and financial companies in particular, can face major hurdles. Compounding their challenges, banks must comply with new regulations such as the U.S. Dodd-Frank legislation that mandates increased capital ratios.

When inflation spikes, which asset classes will prosper? Commodities are a good bet. Although traditional investors can have difficulty negotiating a rising interest rate environment, algorithmic

High-Frequency Traders' Share of Volume

U.S. equities	70%
U.S. futures	40%
Europe equities	30–40%
Europe futures	30–40%
Asia equities	5–10%

Source: Bank of England estimates

High-Frequency Traders Pump Up Volume: Although high-frequency trading remains in its infancy in Asia, it now accounts for the lion's share of volume in U.S. equities trading and about a third of European equities and futures trading.

traders, who find profit in tiny movements of securities, could fare better.

Those algorithmic traders also are responsible for the proliferation of electronic exchanges, which, along with the dearth of initial public offerings in recent years, has eroded the role of major bourses like the New York Stock Exchange.

China on the Rise

Meanwhile, the ascendant Chinese economy is challenging the United States' position as the sole global superpower. As China flexes its muscles, friction with the United States will continue over petroleum reserves, rare metals used in advanced batteries, human rights and other issues. China is the United States'

second-largest trading partner and second-largest creditor, however, and thus China and the United States can be expected to remain in a long-term embrace.

Political turmoil rocking the Middle East also could create economic ripples. If instability continues, or if hostilities break out between Israel and its neighbors, higher crude oil prices likely will reflect the risk of supply disruptions.

Throw into this bouillabaisse of uncertainty a U.S. presidential election. Washington may seem an island of stability, but the wheels of democracy offer the potential of a micro-revolution every four years. A GOP victory almost certainly would mean changes on regulatory and fiscal policy.

In short, expect volatility whatever corner of the earth you occupy. Whatever the political climate, however, one thing is certain: Traders will seek to harness the shifting economic winds and find profit in them. ■
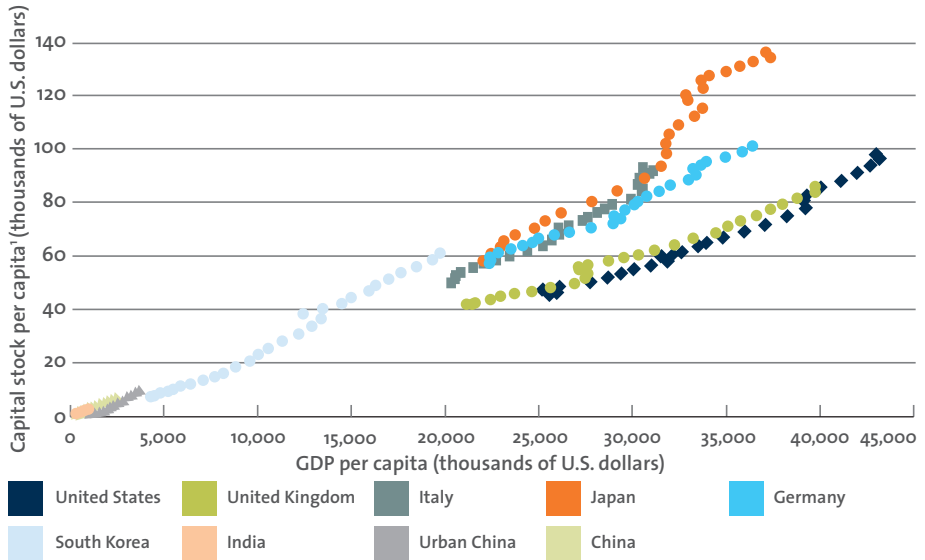
Global M&A on the Rise
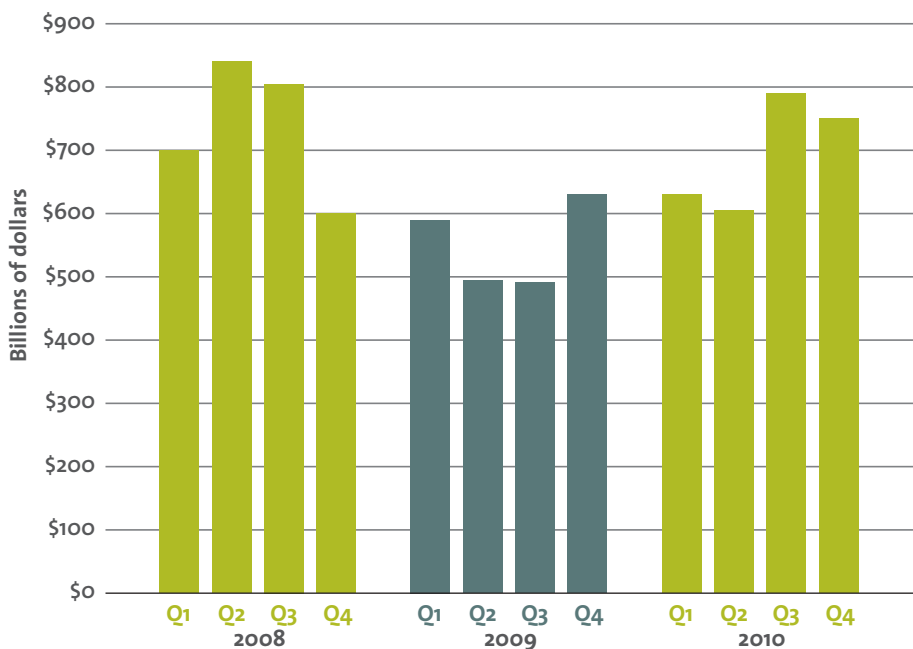
Source: Dealogic

Deal Makers Hit Their Stride: *An economic recovery gave a green light to the merger and acquisition market in the second half of 2010. Early indications in 2011 suggest that the trend will continue.*

The Case for a Global Investment Boom

Capital stock per capita (thousands of U.S. dollars) vs **GDP per capita (thousands of U.S. dollars)**

Legend: United States, United Kingdom, Italy, Japan, Germany, South Korea, India, Urban China, China

Source: McKinsey Global Economic Growth Database, McKinsey Insights China, McKinsey Global Institute
[1] Stock of net fixed assets at the end of the year, assuming 5 percent depreciation rate for all the assets.

Emerging Markets to Fuel Worldwide Investment: Demand for housing, factories, transportation, water and healthcare in China, India and other emerging markets is driving an increase in investment. Before dipping in 2009 amid the financial crisis, investment rose from 20.8 percent of GDP in 2002 to 23.7 percent in 2008, according to a McKinsey Global Institute report.
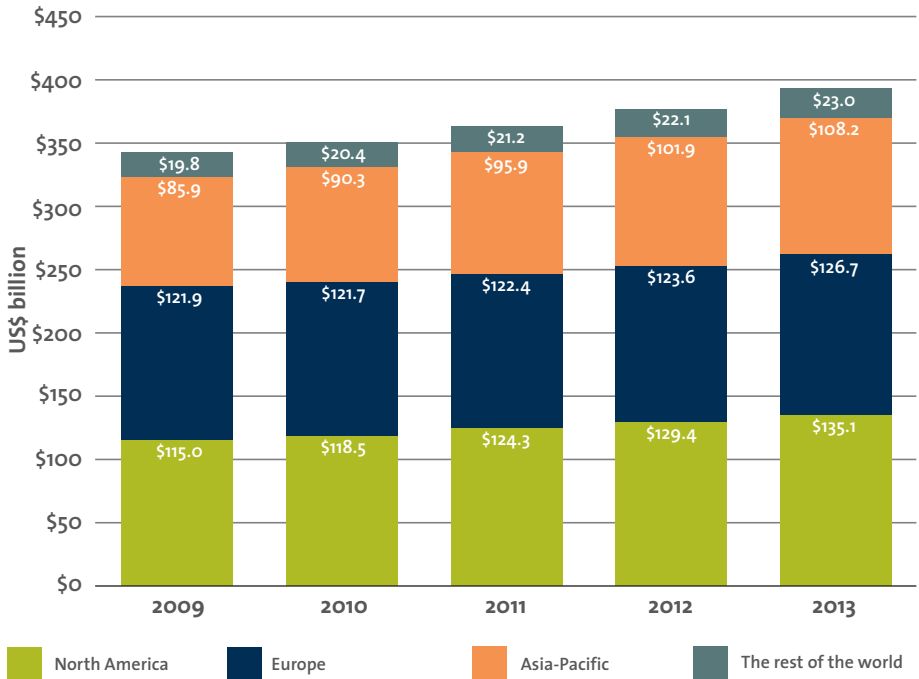
GDP Per Capita Climb
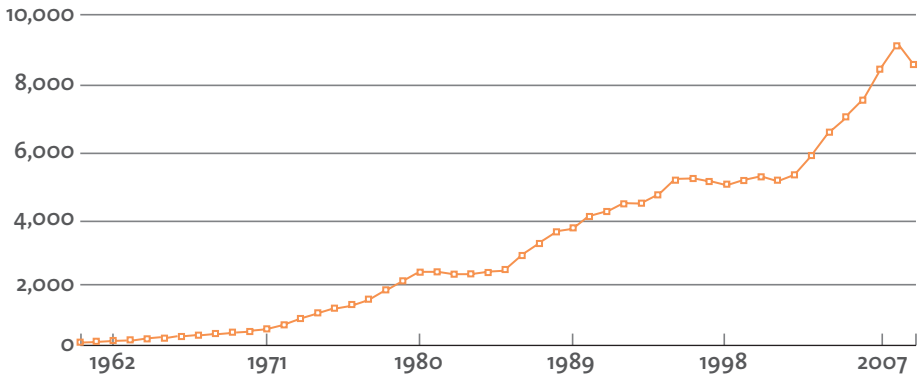
The Per Capita Gross Domestic Product Races Ahead: *Although the financial crisis reversed some gains, the world's gross domestic product per capita has jumped from under $2,000 per person to more than $8,000 since the early 1960s.*

Financial Services Firms Global IT Spending

US$ billion

	2009	2010	2011	2012	2013
The rest of the world	$19.8	$20.4	$21.2	$22.1	$23.0
Asia-Pacific	$85.9	$90.3	$95.9	$101.9	$108.2
Europe	$121.9	$121.7	$122.4	$123.6	$126.7
North America	$115.0	$118.5	$124.3	$129.4	$135.1

■ North America   ■ Europe   ■ Asia-Pacific   ■ The rest of the world

Source: Celent

Spending Accelerates: Celent predicts that 2011 global IT spending will reach $363.8 billion in 2011, a 3.7 percent year-over-year increase. That compares to a 2.5 percent increase.
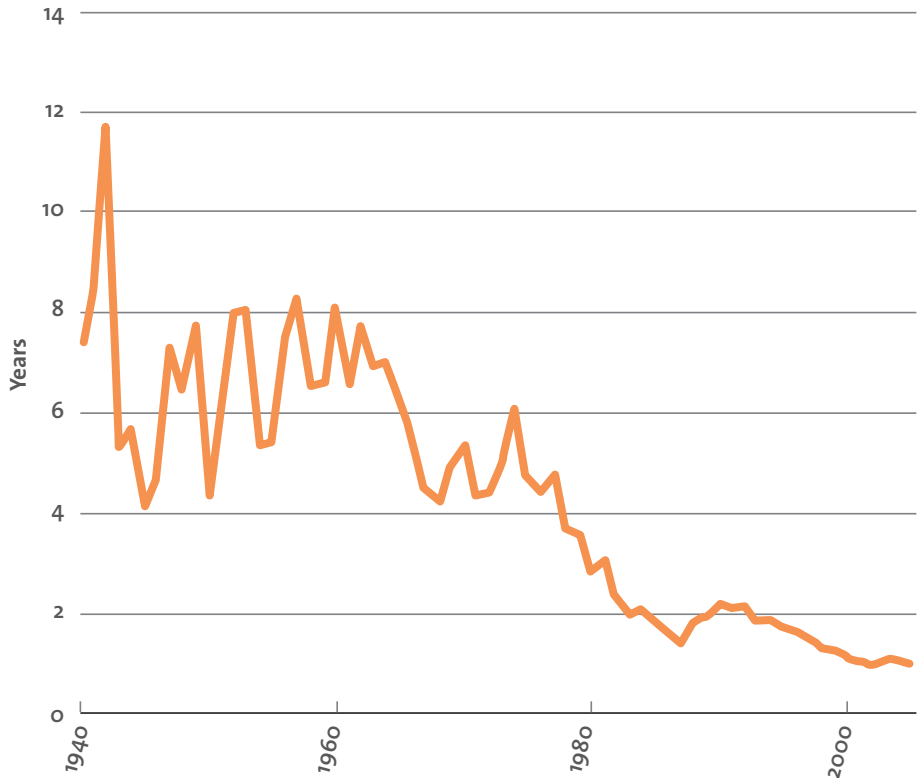
U.S. Trade Balance
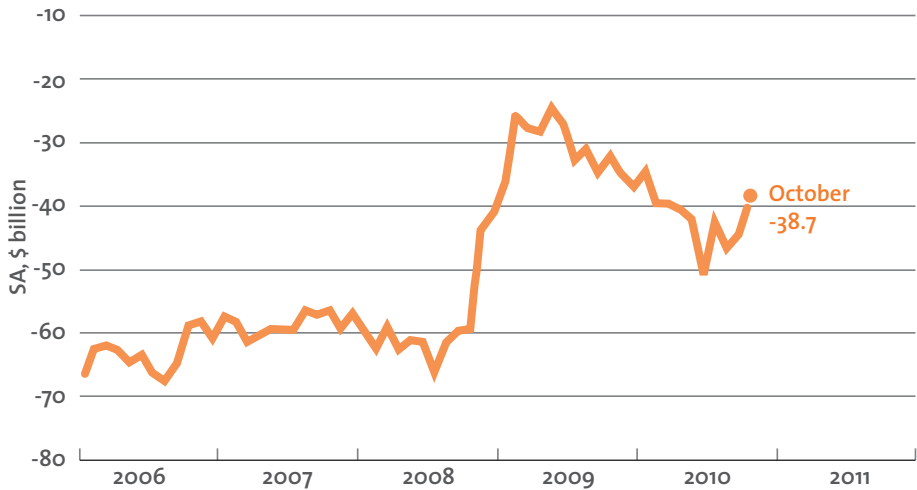
Source: Federal Reserve Bank of New York

Trade Balance Ticks Up: The U.S. trade balance continued in the red in October, but closed the gap a bit to -$38.7 billion. Still, that figure was far better than the levels in 2006 and 2007.
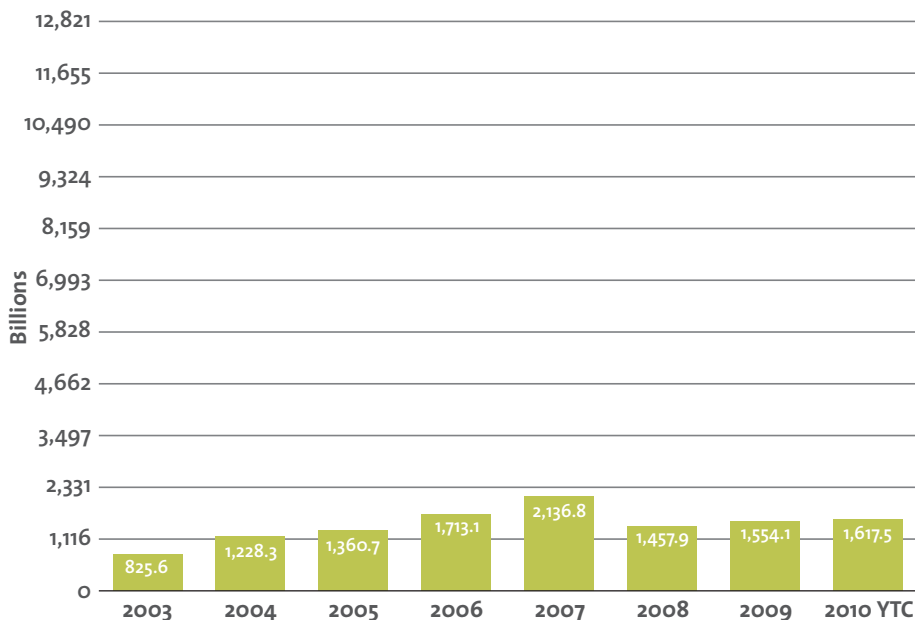
NYSE Average Security Holding Period

Source: New York Stock Exchange

Buy-and-Hold Philosophy on Decline: *Gone are the days when an investor would buy a security and tuck it away for life. That is clear from the dramatic decline in holding periods among investors on the New York Stock Exchange.*

Hedge Funds' Assets under Management

Source: BarclayHedge

Hedge Fund Assets Climb: *Hedge fund assets (not including fund of funds) have marched steadily higher since the crisis-plagued year of 2008, although they remain below their 2007 peak.*

Hedge Fund Performance

|	2010	2009	2008	2007	2006
January	-0.41%	-0.14%	-3.26%	1.13%	3.50%
February	0.76%	-1.46%	1.23%	0.79%	0.61%
March	2.82%	2.04%	-2.38%	0.91%	1.97%
April	1.27%	4.27%	1.93%	1.59%	1.73%
May	-3.23%	5.57%	1.82%	2.00%	-1.84%
June	-1.05%	0.37%	-1.73%	0.72%	-0.39%
July	1.93%	2.97%	-2.10%	0.37%	0.02%
August	-0.40%	1.78%	-1.21%	-1.45%	0.96%
September	3.47%	3.19%	-6.99%	2.51%	0.11%
October	1.98%	-0.06%	-8.41%	2.87%	1.80%
November	0.52%	1.33%	-2.80%	-2.07%	1.76%
December	2.95%†	1.84%	0.37%	0.52%	1.61%
YTD	10.92%*	23.74%	-21.63%	10.22%	12.39%

Source: The Barclay Hedge Fund Index
†Estimated performance for December 2010 calculated with reported data from 3018 funds
§Estimated performance for November 2010 calculated with reported data from 3,170 funds
*All estimates and 2010 YTD amounts are calculated with reported data as of January 28, 2011

Hedge Funds Notch Double-Digit Return: Hedge fund performance moderated after a stellar 2009, but still managed an average yearly return of about 11 percent in 2010, according to The Barclay Hedge Fund Index, a measure of the average return of all hedge funds (excepting fund of funds).

Hedge Fund Managers Pull Back Their Horns
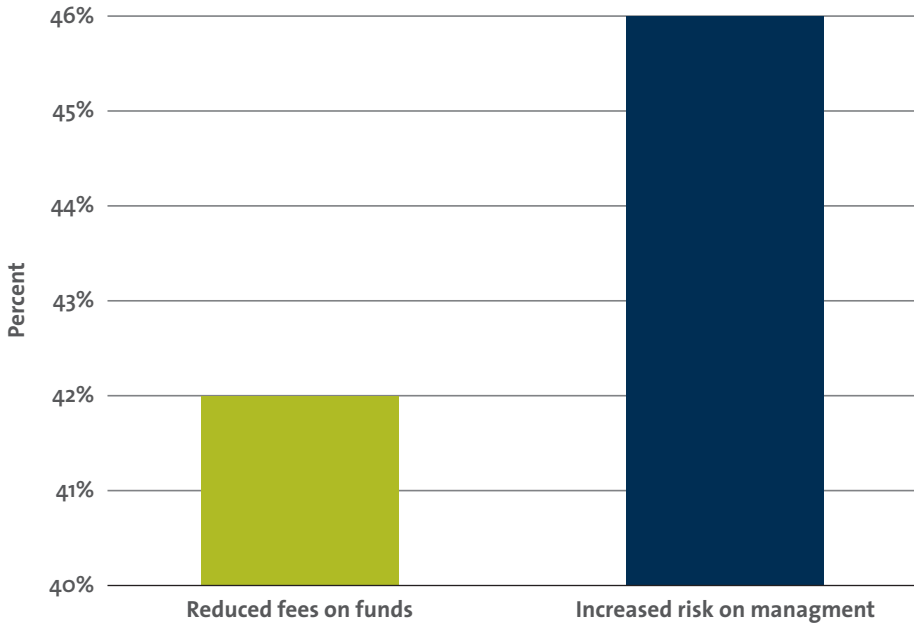
Source: Prequin

Pulling Back Their Horns: More than 40 percent of hedge fund managers, chastened by industry scandals and economic turmoil, said they were reducing fees on their funds and increasing risk management, according to a Preqin survey.

Top Buyouts in 2010

| Name	Date	Type	Deal size (mn)	Currency	Buyers	Sellers	Industry	Location
Del Monte Foods Company	Nov 2010	Public To Private	5,300	USD	Centerview Partners, Kohlberg Kravis Roberts, Vestar Capital Partners		Food	U.S.
Tomkins plc	Jul 2010	Public To Private	3,150	GBP	CPP Investment Board, Onex Corporation		Engineering	U.K.
NBTY	Jul 2010	Public To Private	4,048	USD	The Carlyle Group		Food	U.S.
Extended Stay	May 2010	Buyout	3,925	USD	Blackstone Group, Centerbridge Capital Partners, Paulson & Co.		Leisure	U.S.
CommScope	Oct 2010	Public To Private	3,900	USD	The Carlyle Group		Commun-ications	U.S.
Interactive Data Corporation	May 2010	Public To Private	3,700	USD	Silver Lake, Warburg Pincus		Financial services	U.S.
Sunrise	Sep 2010	Buyout	3,300	CHF	CVC Capital Partners	TDC A/S	Telecoms	
Multiplan, Inc.	Jul 2010	Buyout	3,100	USD	BC Partners, Silver Lake	The Carlyle Group, Welsh, Carson, Anderson & Stowe	Healthcare IT	U.S.
J Crew Group, Inc.	Nov 2010	Public To Private	3,000	USD	Leonard Green & Partners, TPC		Retail	U.S.

Source: Prequin

Deals Sate Private Equity Hunger: *The $5.3 billion deal to take Del Monte Foods private was the largest private equity buyout of 2010, according to Preqin. Not far behind was The Carlyle Group's move to take nutritional supplement maker NBTY private.*
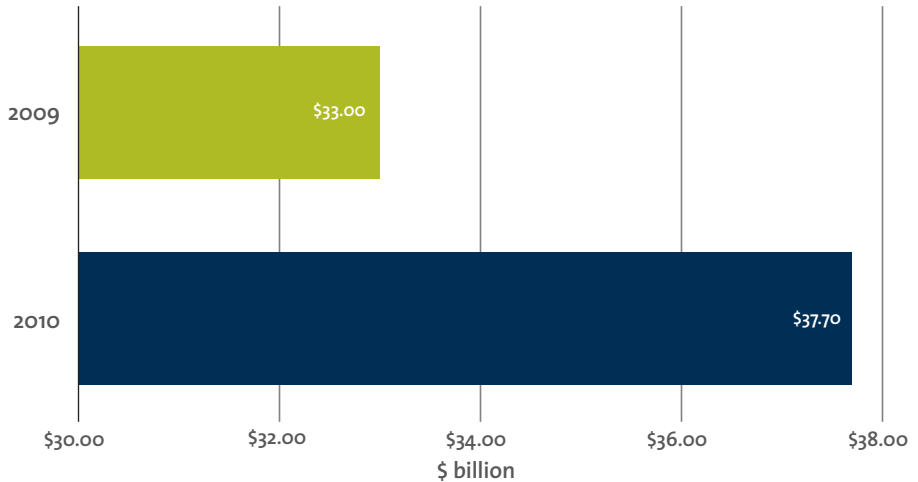
Private-Equity Buyouts Rebound
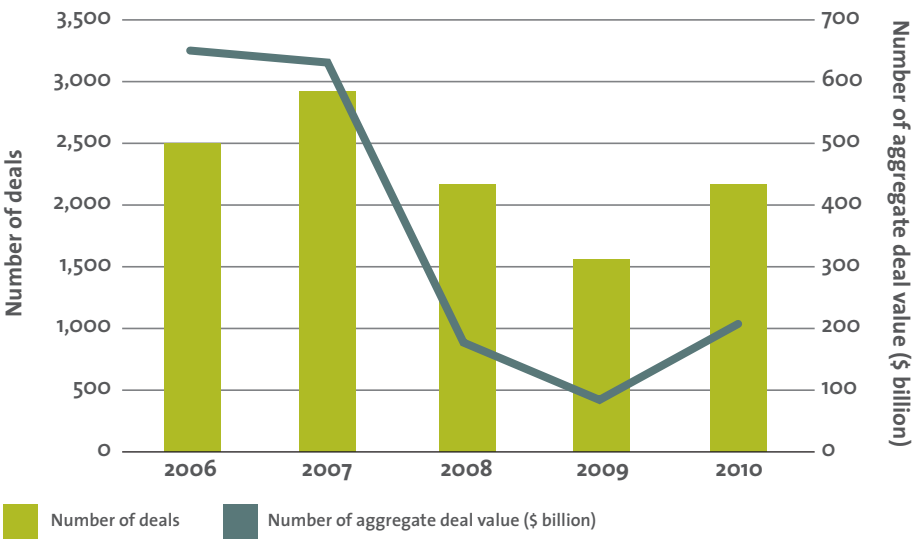
Source: Prequin

A Year of Recovery: The value of private-equity-backed buyouts worldwide bounced back in 2010, exceeding $400 billion, roughly equal to 2008 levels. That remained well below the nearly $600 billion in 2007.

Global Venture Capital Investment Climbs

2009 — $33.00
2010 — $37.70

$ billion

Source: Dow Jones VentureSource

Global Venture Capital Rises: *Coming out of the recession, global venture capitalists were willing to take more risk and bumped up their investments.*

For 2010, U.S. Venture Capital Bounces Back

2009			2010		
Period	Number of deals	Amount invested	Period	Number of deals	Amount invested
Q1	637	$3,389,777,500	Q1	763	$4,961,248,000
Q2	710	$4,289,697,500	Q2	960	$6,900,202,300
Q3	716	$5,211,852,500	Q3	789	$4,944,927,100
Q4	864	$5,384,416,300	Q4	765	$5,017,002,700
Yearly	2,927	$18,275,743,800	Yearly	3,277	$21,823,380,100

Source: PricewaterhouseCoopers/National Venture Capital Association
MoneyTree™ Report, Data: Thomson Reuters

Venture Capital Rebounds: *After a dismal 2009, venture capital showed signs of life in 2010 as the number of deals and amount invested nationwide eclipsed the year-ago figures.*
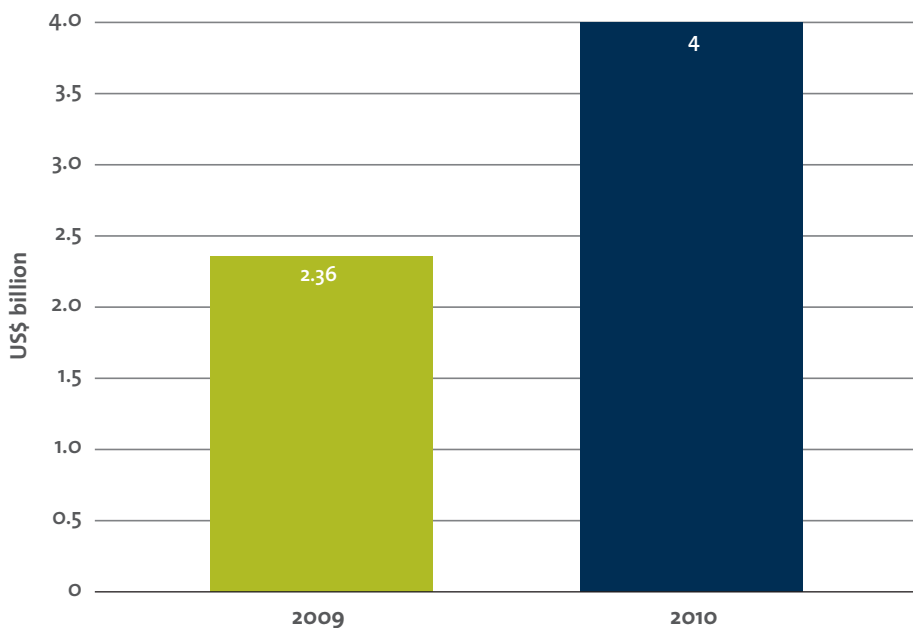
Venture Capitalists Pump Up Investment in Fourth Quarter

Source: Dow Jones & Co.

Venture Perks Up: *After a slow third quarter, venture capitalists closed more deals and poured more capital into startups.*
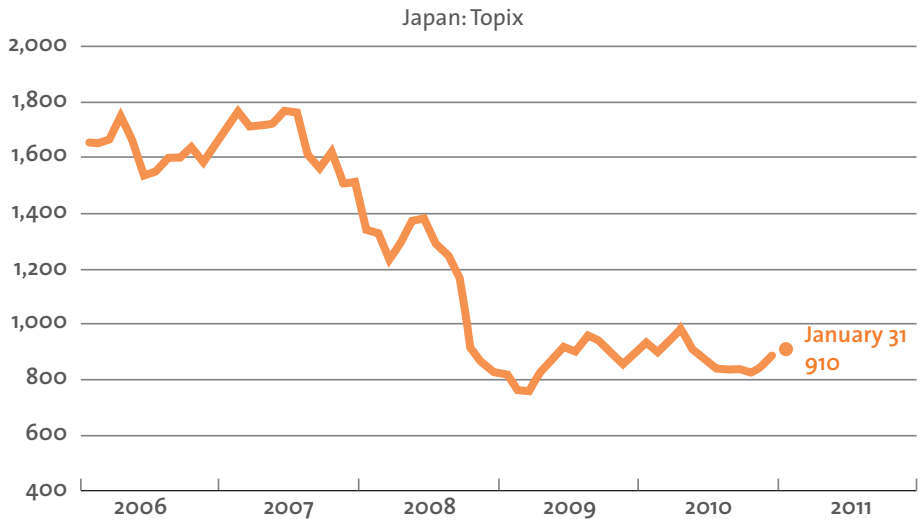
China's Venture Capital Investment Leaps 59%

Source: Dow Jones VentureSource

China Venture Capital Surges: *The United States remains the leader in venture capital, but China is gaining rapidly as its huge domestic market and export economy fuel growth.*
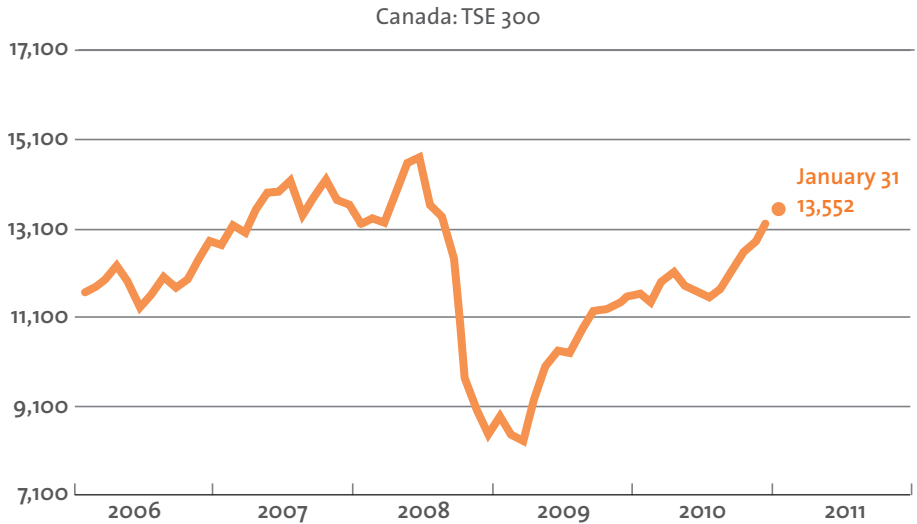
No Relief for Japan

Japan: Topix

Source: Federal Reserve Bank of New York

Japan's Topix Index Remains Depressed: *Japanese stocks plateaued in 2010 after enduring a steep decline in 2007 and 2008.*

Commodities Drive Canada's Gain
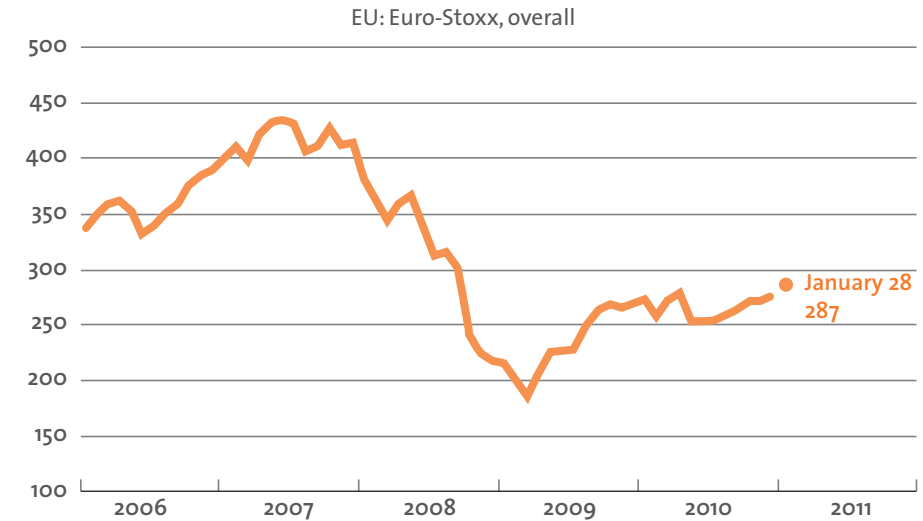
Canada: TSE 300

January 31
13,552

Source: Federal Reserve Bank of New York

TSE 300 Registers Strong Gain: *Oil prices climbed and bulls piled into gold and other precious metals in 2010. That gave a boost to Canadian equities, which are heavily weighted toward natural resources.*

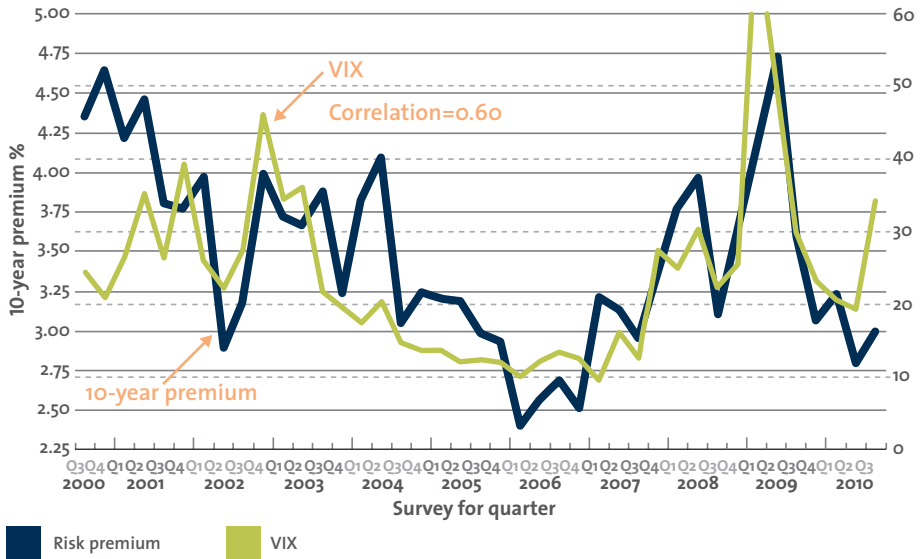# Debt Woes Drag European Stocks

EU: Euro-Stoxx, overall

January 28
287

Source: Federal Reserve Bank of New York

Fallout Weighs on Euro-Stoxx Index: Financial crises in Greece and elsewhere kept a lid on European equities, which had a choppy ride in 2010.

Correlation Between the Risk Premium and the VIX (S&P 500 option)

Source: John Graham and Campbell Harvey, *The Equity Risk Premium in 2010*, Duke University Fuqua School of Business

Strong Link Found: *The equity risk premium, the expected 10-year S&P 500 return relative to a 10-year U.S. Treasury bond yield, had a strong correlation to the Chicago Board Options Exchange Market Volatility Index (the S&P 500 option), according to a study by two Duke University professors. The equity risk premium was based on a survey of chief financial officers and their expectations for the S&P 500 vs. a Treasury bond yield.*

Exchange Domestic Equity Capitalizations

	Exchange	US$ billion end 2010	US$ billion end 2009	% change in US$	% change in local currency
1	NYSE Euronext (U.S.)	13, 394	11,838	13.2%	13.2%
2	NASDAQ OMX (U.S.)	3,889	3,239	20.1%	20.1%
3	Tokyo Stock Exchange Group	3,828	3,306	15.8%	0.9%
4	London Stock Exchange Group	3,613	3,454	4.6%	11.9%
5	NYSE Euronext (Europe)	2,930	2,869	2.1%	9.2%
6	Shanghai Stock Exchange	2,716	2,705	0.4%	-3.1%
7	Hong Kong Stock Exchange	2,711	2,305	17.6%	17.9%
8	TMX Group	2,170	1,677	29.4%	20.0%
9	National Stock Exchange of India	1,597	1,225	30.4%	25.3%
10	BM&FBOVESPA	1,546	1,337	15.6%	10.1%

Source: World Federation of Exchanges

NYSE Euronext Rules the Roost: *Although other stock exchanges showed faster growth, most notably the National Stock Exchange of India, NYSE Euronext posted the largest domestic equity capitalization by far.*

S&P 500 Rallies

United States: SP500

January 31
1,286
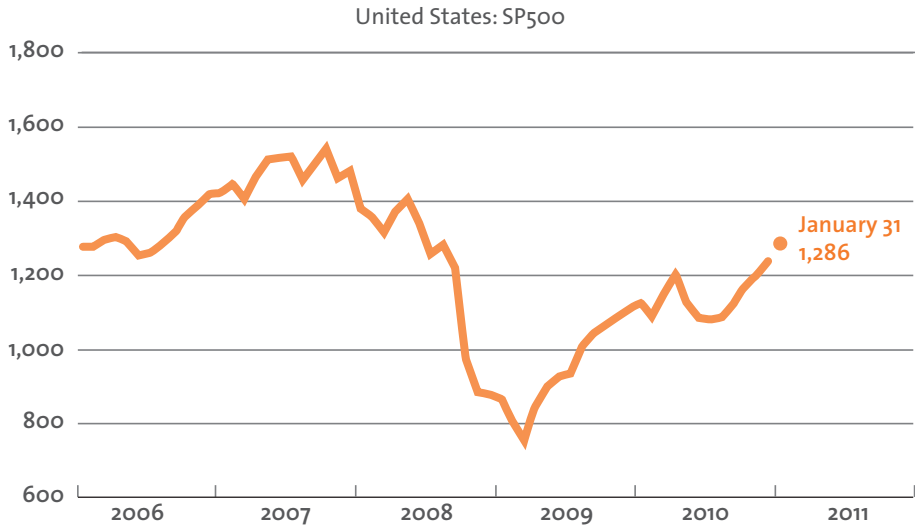
Standard & Poor's 500 Trends Up: *The S&P continued its recovery from the depths of 2009 despite a midyear dip.*

London No. 1 in Financial Center Ranking

Financial Center	GFCI 8 Rank	GFCI 8 Rating	GFCI 7 Rank	GFCI 7 Rating	Change in Rank		Change in Rating	
London	1	772	=1	775	-		▼	3
New York	2	770	=1	775	▼	1	▼	5
Hong Kong	3	760	3	739	-		▲	21
Singapore	4	728	4	733	-		▼	5
Tokyo	5	697	5	692	-		▲	5
Shanghai	6	693	11	668	▲	5	▲	25
Chicago	7	678	6	678	▼	1		-
Zurich	8	669	7	677	▼	1	▼	8
Geneva	9	661	8	671	▼	1	▼	10
Sydney	10	660	=9	670	▼	1	▼	10

Source: Z/Yen Group

London Edges Out New York: *London took the top spot in the annual survey of global financial centers. The study looks at factors such as the business environment, taxation, infrastructure and government support in ranking the centers. Of note: Hong Kong remained in third place, but was a mere 10 points behind Nos. 1 and 2. Shanghai charged up five spots to land at No. 6.*

Hong Kong Has a Growth Spurt

Hong Kong Stock Exchange

	Main board	GEM
Number of listed securities December 31, 2009	6,441	175
Number of listed securities December 31, 2004	1,971	205
Total market capitalization (billions of dollars) December 31, 2009	HKD 17,769	HKD 105
Total market capitalization December 31, 2004	HKD 6,629	HKD 87

Source: Hong Kong Stock Exchange

A Growth Story: *Hong Kong, long a financial center, continues its rapid growth in step with China's economy. Also growing at a rapid clip are the Shanghai and Shenzhen stock exchanges.*

Market Capitalization by Region

Market capitalization (year-on-year)	December 2010 (US$ billion)	% change /year on year
Americas	22,173	17.1%
Asia-Pacific	17,435	19.5%
Europe Africa Middle East	15,277	7.4%
Total	54,884	14.9%

Source: World Federation of Exchanges

Asia-Pacific Gains in Market Capitalization: *Asia-Pacific (excluding New Zealand) posted the largest year-over-year gain in stock market capitalization, according to the World Federation of Exchanges, which counts 52 bourses as members.*

Euro Area Long-Term Interest Rates
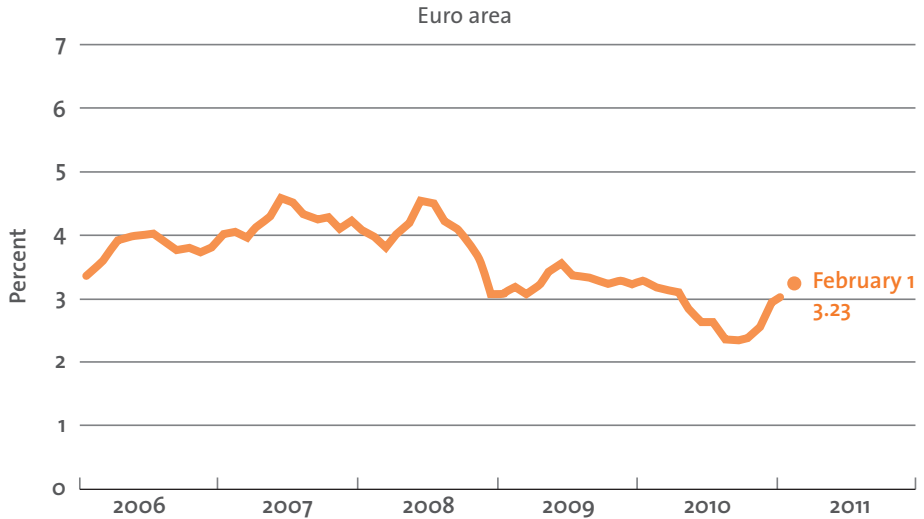
Euro area

Source: Federal Reserve Bank of New York

Long-Term Rates Remain Low: *Interest rates in the euro area, as well as the United States and Canada, remained low, although all had ticked above 3 percent as of early 2011. Japan's rates, meanwhile, settled at 1.23 percent as of February 1.*

2011 U.S. Industry Forecast

Employment growth	Percent	Revenue growth	Percent
Oilfield services and production	4.9	Oil and gas refining and marketing	26.3
Environmental services	4.1	Manufacturing housing and RVs	23.1
Aerospace and defense	3.3	Steel	19.4
Biotechnology	2.5	Internet	19.4
Restaurants	2.5	Biotechnology	16.7
Computer software and services	2.4	Chemicals	16.4
Industrial machinery	2.4	Medical services	15.7
Medical services	1.9	Homebuilding	15.0
Trucking	1.9	Industrial services	13.2
Industrial services	1.8	Medical supplies	13.1

Sources: Moody's Economy.com, Grubb & Ellis Company

Employment and Revenue Growth for the Top 10 Industries: Oil-related businesses are in line to lead industry growth in employment and revenue growth. Biotechnology and medical services also are predicted to make the top 10 in both categories.

U.S. Recession Probability

December 2011
= 0.57%
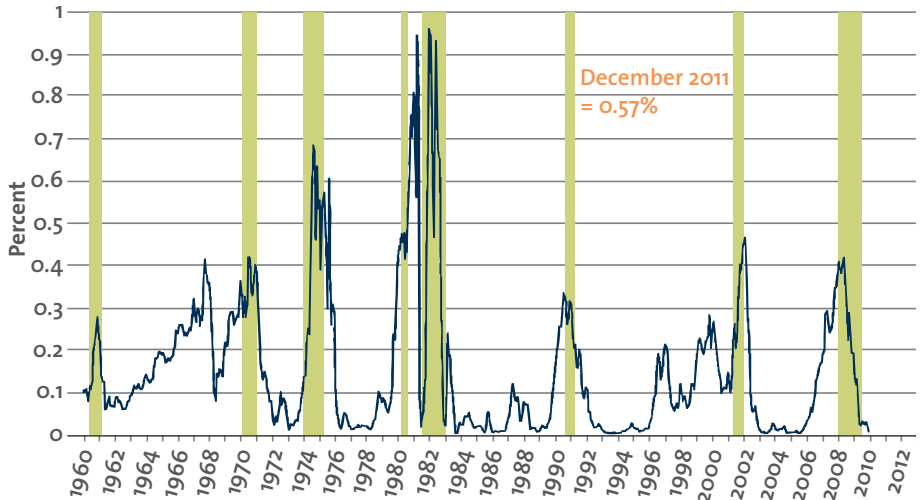
Source: Federal Reserve Bank of New York

Recession Barometer Gives All-Clear: *The Federal Reserve Bank of New York tracks the spread between the 10-year bond and the 3-month note as a leading indicator of oncoming recessions. The latest reading shows scant risk of a double-dip recession.*

Top U.S. Real Estate Markets Forecast

U.S. Office Market Strength Forecast

United States	Rank
New York City, New York	1
Washington, D.C.	2
Portland, Oregon	3
Boston, Massachusetts	4
Los Angeles, California	5
San Diego, California	6
San Francisco, California	7
Oakland-East Bay, California	8
Raleigh-Durham, North Carolina	9
Austin, Texas	10

Source: Grubb & Ellis Company
*Markets were ranked from 0 to 100 against 15–20 property, economic and demographic variables

Big Apple Office Space in Demand: *Although its financial sector took a drubbing in the rout of mortgage securities, New York City was forecast to be the No. 1 office market for the 2010 to 2015 period, according to Grubb & Ellis.*

U.S. Industrial Market Strength Forecast

United States	Rank
Houston, Texas	1
Los Angeles, California	2
Oakland-East Bay, California	3
Dallas-Fort Worth, Texas	4
Seattle, Washington	5
Inland Empire, California	6
Chicago, Illinois	7
Atlanta, Georgia	8
Portland, Oregon	9
Miami, Florida	10

Source: Grubb & Ellis Company
*Markets were ranked from 0 to 100 against 15–20 property, economic and demographic variables

Industrial Market Skews to South and West: *Houston and Los Angeles shared the top two positions in a forecast of the industrial real estate market. Among the top 10 markets, only Chicago was not in the South or West.*

U.S. Retail Market Strength Forecast

United States	Rank
Washington, D.C.	1
Los Angeles, California	2
New York City, New York	3
San Francisco, California	4
Portland, Oregon	5
San Diego, California	6
Boston, Massachusetts	7
Long Island, New York	8
Chicago, Illinois	9
Seattle, Washington	10

Source: Grubb & Ellis Company
*Markets were ranked from 0 to 100 against 15–20 property, economic and demographic variables

Nation's Capital Tops Retail Forecast: Buoyed by federal employees, Washington D.C., was ranked the top retail real estate market for 2010 to 2015. Washington was followed by Los Angeles and New York City.

U.S. Apartment Market Strength Forecast

United States	Rank
New York City, New York	1
San Francisco, California	2
Long Island, New York	3
San Jose-Silicon Valley, California	4
Los Angeles, California	5
Oakland-East Bay, California	6
Washington, D.C.	7
Orange County, California	8
Westchester County, New York	9
San Diego, California	10

Source: Grubb & Ellis Company
*Markets were ranked from 0 to 100 against 15–20 property, economic and demographic variables

Going Up: Like the elevators of its high-rise apartment buildings, the New York City market will continue to ascend, according to Grubb & Ellis. Following New York City on the list were San Francisco and the New York City suburb of Long Island.

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People in financial services, telecommunications, manufacturing, engineering and many other fields use these tools to speed up business processes, reduce operational and investment risks, detect anomalies (including fraud) and identify opportunities to increase profits and sales. Panopticon is available in three versions: Panopticon EX enterprise application; the Rapid Development Kit; and an SDK supporting Java, .NET and Microsoft WPF environments.

For more information, visit panopticon.com

Quantia Analytics, LLC, delivers robust, efficient and cost-effective market data solutions for research and trading in global electronic markets. Quantia provides its TrueTick solutions for trading organizations that must master the intersection of data, technology and trading. Quantia's TrueTick toolkit comprises business processes for cleaning, deeply normalizing, analyzing and monitoring market tick data. These processes provide accurate and timely market state information and summaries. TrueTick analytics reduce data volumes and support pre-trade analysis, optimal trading and execution, and transaction cost analysis. TrueTick data streams serve researchers, quant traders, program traders, black box traders and risk managers in sell-side and buy-side electronic trading organizations. Traders can confidently exploit all market conditions, avoid costly errors and save time and money using TrueTick.

For more information, visit quantia.com

Revolution Analytics is a leading commercial provider of software and services based on the open source R project for statistical computing. Led by predictive analytics pioneer Norman Nie, the company brings high performance, productivity and enterprise readiness to R, the most powerful statistics language in the world. The company's flagship Revolution R product is designed to meet the production needs of large organizations in industries such as finance, life sciences, retail, manufacturing and media. Used by more than 2 million analysts in academia and at cutting-edge companies such as Google, Bank of America and Acxiom, R has emerged as the standard of innovation in statistical analysis. Revolution is committed to fostering the continued growth of the R community and sponsors the Inside-R.org community site, user groups worldwide and offers free licenses of Revolution R Enterprise to everyone in academia.

For more information, visit revolutionanalytics.com

TABB Group is a research and strategic advisory firm focused exclusively on global institutional capital markets. Our research and consulting practices provide depth across a number of specialized topics: advanced execution, market structure, market sizing, competitive analysis and the associated enabling technologies. Our mission is to help senior business leaders gain an enhanced understanding of the trends in their key markets and translate that into practical, actionable strategies that provide a competitive edge. Our staff have decades of experience on the front lines, affording us a deep understanding of the markets, their structure and current trends. This experience enables us to assist our clients to benchmark their businesses, understand their options and take the appropriate actions.

For more information, visit tabbgroup.com

TraderTools. delivers a complete, integrated FX trading platform. Banks and brokerages use the TraderTools platform to increase revenues, reduce costs, improve spreads and access vital information to help run their FX businesses more efficiently and effectively.

FX desks traditionally deploy an assortment of vertical tools, developed internally or externally by different vendors. TraderTools replaces these disparate products with a single innovative platform that addresses the four most pressing FX challenges: liquidity aggregation, pricing engine, white-labeling and global order management. It is an end-to-end solution designed to work seamlessly across all components and provide unparalleled visibility into the entire FX workflow. The result is an optimized FX Liquidity Management Platform—with advanced capabilities, such as algorithmic trading and auto-hedging—designed to generate profits.

TraderTools' FX trading platform is the product of more than a decade's worth of experience with some of the world's largest financial institutions.

For more information, visit tradertools.com

CEP's mission is to make all types of available data— across each layer of a firm's IT system— comprehensible in relation to business goals and actionable in real time.

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