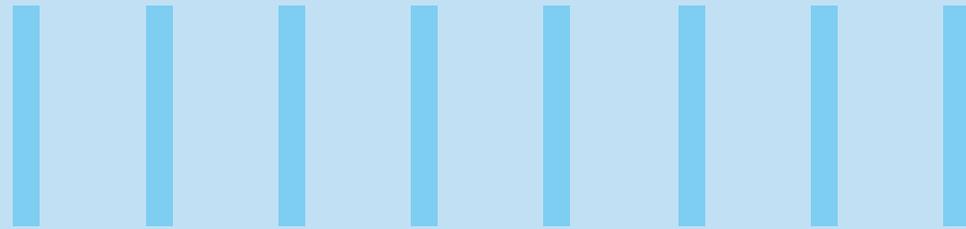




IMPERATIVES OF EFFECTIVE MARKET RISK MANAGEMENT IN THE NEW NORMAL



Abstract

Since its onset, COVID-19 has been making a huge negative impact on the global financial markets. For example, in 2020, market volatility levels and daily value at risk (VaR) measures for the global investment banks had surged to their highest since the 2007-08 Global Financial Crisis. Today, financial institutions continue to grapple with the myriad of market risks-related challenges brought on by the pandemic. Institutions therefore need to act strategically and focus on certain key dimensions to effectively manage their market risks.

The Pandemic has jolted the global economy

The pandemic has been having a huge negative impact on the global financial markets ever since its onset. Across the world, in the aftermath of COVID-19, consumption declined, industrial production nosedived, firms' revenues took

a hit, and supply chains got disrupted. GDPs of several major nations have contracted. There has been massive rise in unemployment levels and the erosion of personal wealth. As per IMF, the global economy was estimated

to shrink by 4.4% in 2020 — making it the worst annual contraction since the Great Depression of 1930s. In comparison, globally the economy had contracted by much lesser 0.1% after the 2008 Global Financial Crisis.¹

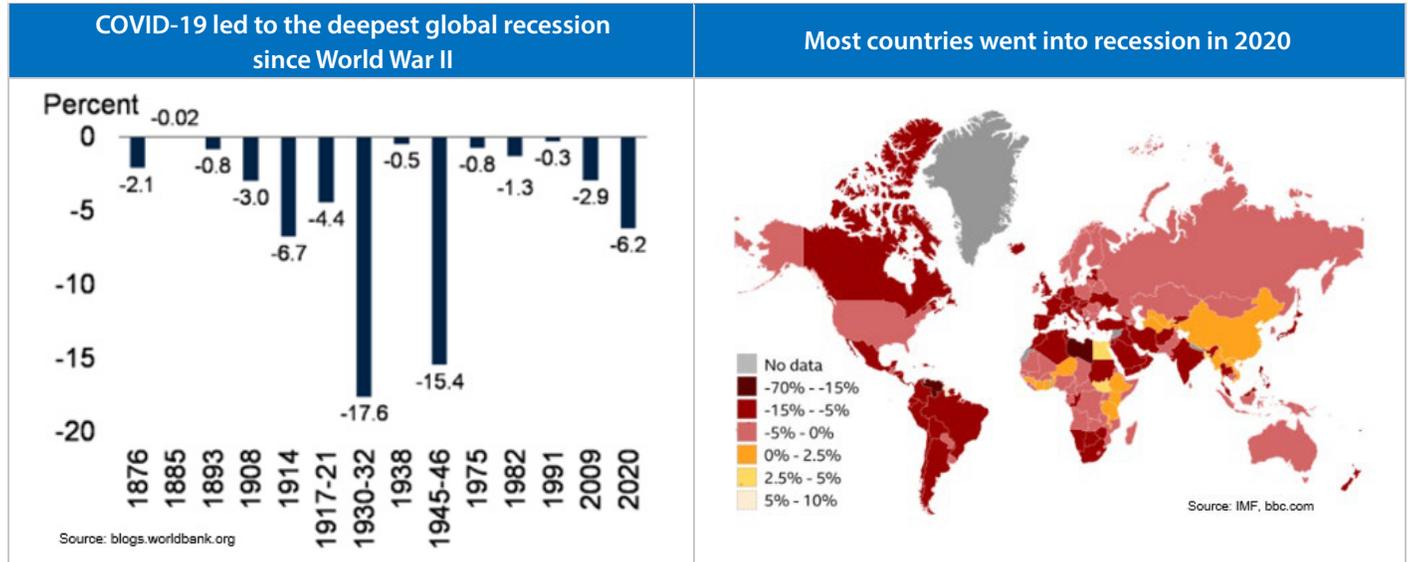


Figure 1: Global per capita GDP growth in recessions since 1870²

Figure 2: Real GDP growth in 2020³

Financial institutions continue to struggle in the face of heightened market risks

Since the beginning of the pandemic, several financial institutions (FIs) have been grappling with high asset correlation and market volatility — across equities, commodities, foreign exchange, derivatives, interest rate, and more. 2020 had seen market volatility levels and daily VaR measures for global investment banks surge to their highest since the 2007-08 Global Financial Crisis. Resultantly, there has been a significant rise in risk-weighted assets (RWA) capital being reported by major banks across the globe. Several banks' fee income and net interest income has decreased significantly, due to reduced banking activity, sharp decline in interest rate, and tepid loan demand. As per FDIC, in 2020, the net income of American deposit taking banks declined by 36.5 percent YOY.⁴

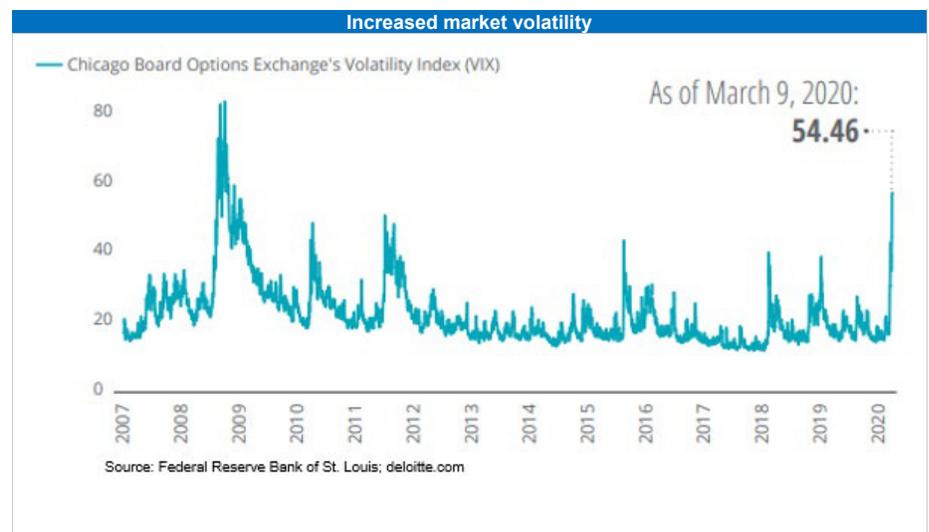


Figure 3: VIX — an indicator of stock market volatility based upon S&P 500 index options — witnessed substantial rise⁵

Refer figure 4 for a snapshot of the key market risk impacts on FIs since the onset of the pandemic.

Increased volatility and asset correlation	Increased VaR	Decline in asset and collateral value	Negative impact on capital adequacy and RWA
Reduced value of assets under management (AUM)	Hedging strategy and balance sheet impacts	High trading and mark to market (MTM) losses	Reduced income and profit
Credit quality deterioration; increased loan loss provisions	Increased counterparty risk	Liquidity crunch; increased market and funding liquidity risks	High variations in liquidity stress testing (LST) results
Increased interdependence and contagion risk	Higher number of backtesting exceptions, and limit threshold breaches	Increased regulatory scrutiny	Increased stress level of MRM models and systems

Figure 4: Huge impact on FIs' market risk management (MRM) aspects post COVID-19

FIs are facing increased regulatory scrutiny vis-à-vis the soundness and effectiveness of their market risk management (MRM) practices. For example, post the onset of COVID-19, Bank of England had stated that it is examining the macro-financial impacts of the pandemic on market functioning.⁶ Similarly, in U.S., in October 2020, the Federal Reserve Board emphasized that banks need to consider their trading book losses — resulting from changes in value of assets or derivative instruments due to COVID-19 — within the market risk capital

rule and not classify these as operational losses.⁷

Given the above, it is no wonder that FIs' MRM systems and models too have come under severe strain. For example, banks' existing models — such as those related to valuation and pricing, VaR, RWA, asset and liability management (ALM), and liquidity and capital forecasting — have been unable to perform effectively in current stressed economic scenarios. Moreover, owing to substantial rise in recent years in the complications and sophistication levels

of the trading products and associated risk factors, FIs' market risk-related models have become highly complex. The introduction of new valuation adjustment standards (e.g., XVA) in recent years have further added to these models' complexities and computational demands.

Additionally, several FIs lack robust MRM systems and data infrastructure. As per a survey report, 70% of treasury functions lack the required data, modeling, and analytical capabilities to effectively manage their balance sheet and risks.⁸

Overcoming market risk challenges: Key imperatives for financial institutions

To overcome the abovementioned challenges, FIs need to earnestly work on the below four key dimensions.

Strategic imperatives	Governance
Model & data management	Technology transformation

Figure 5: Key MRM improvement dimensions



- **Strategic imperatives:** FIs should work towards effectively managing the market volatility, capital, liquidity, and interest rate risks. Also, they should bolster their market risk measurement and modeling, and stress testing capabilities. Refer below some of the key recommendations for FIs in this regard.

Market volatility management	<ul style="list-style-type: none"> o Take concrete actions to manage the market volatility — for example, a) enhance their CVA / DVA / XVA methodologies and the monitoring framework; b) use full revaluation methodology instead of sensitivity-based approach to factor in the impact of market volatility; c) reallocate risk-based limits on trading book sensitivities to reflect the new market conditions
Asset and capital management	<ul style="list-style-type: none"> o Adopt prudent strategies to conserve capital — for example, a) bolster capital allocations and hedging strategies by adding flexibility to the defined instruments and hedge ratios; b) revisit assets valuation assumptions and adopt sophisticated fair value adjustment methods; c) strategically raise fresh capital from the market (in case there is risk of RWA falling below the minimum capital adequacy requirement); d) defer dividend payment
Liquidity management	<ul style="list-style-type: none"> o Double down on managing the liquidity risks — for example, a) frequently and actively monitor the liquidity stress early warning indicators (EWIs), intraday liquidity status, and the liquidity stress testing reports; b) conduct ad hoc refresh of cashflow projections (vis-à-vis prepayment and default, “flight to quality” effect on deposits etc.); c) undertake structural funding stability related actions
Interest rate risk management	<ul style="list-style-type: none"> o Actively analyze the interest rate risks and take corrective action — for example, vis-à-vis a) impact of sudden reduction in interest rates; b) P&L impact of interest rate derivatives under continued low interest scenario o Where feasible, seek central bank’s support vis-à-vis enabling tools such as CRR, SLR, and repo rate changes
Market risk measurement and modeling	<ul style="list-style-type: none"> o Adopt sophisticated measures such as stressed VaR (SVaR) in place of the traditional VaR. Unlike VAR, which is very procyclical in nature with a one-year lookback period; SVaR has a much bigger lookback horizon. Resultantly, it is a more stable measure, especially during times of crisis o Review and recalibrate the existing internal market risk-related models — VaR, expected shortfall (ES), capital forecasting, cash flow forecasting, funding, and market liquidity risks, ALM, pricing, valuation, P&L, etc. — to align with the new market reality
Stress testing	<ul style="list-style-type: none"> o Bolster market risk stress testing — for example, a) strengthen stress testing and back testing framework and include additional forward-looking pandemic-induced stress scenarios; b) actively stress test against run on deposits — for both retail and corporate deposits

- **Governance:** FIs should focus on strengthening their MRM governance. Towards this, they need to set the right tone, standards, and expectations for MRM. They should work on establishing well-defined MRM-related roles and responsibilities for all employees (from senior management to trading desks staff). Importantly, employees’ incentives should be linked to good risk behaviors (and not just be based on profits). Front office businesses should be held accountable for excessive risks.

Institutions should implement effective ring fencing to crystallize the boundaries between banking and trading books and amongst the various lines of businesses and functions. Focus should be on improving collaboration between risk management, compliance, finance, treasury, and other business functions, and at the same time ensuring effective operational separation between these functions.

Firms should strengthen their communication (with regulators and other concerned stakeholders) and decision-making processes. Towards this, FIs can consider diversifying their key treasury activities on geographic basis and giving more power to regional treasury centers to manage the risks. Similarly, FIs can consider providing the treasury function greater control over the money market and repo desks, as appropriate. Such changes would improve operational efficiency and the ability of firms to react quickly.

- Model and data management:** Firms need to strengthen their model risk management capabilities — vis-à-vis model development, validation, governance etc. Towards this, FIs should review and build inventory of the models at risk. Further, they could adopt model factory to support the risk models standardization and rationalization. For risk models optimization, FIs can adopt champion and challenger approach. In this approach, the existing models are retained, and in parallel alternatives models are deployed as test. The differences in the prediction from both the models are then analyzed to periodically optimize the existing models.
- MRM is highly data and calculations intensive. For instance, high quality data is crucial for models' calibration, testing and performance. Similarly, to enable reduction in VaR window lag, which is needed to lessen the back testing exceptions and incorporate recent volatile shocks in time series data, better and more varied data is required. Hence, firms should focus on bolstering their data quality and availability. Also, they should work towards leveraging more comprehensive array of internal and external data sources, both structured and unstructured. Also, firms should consider centralizing their MRM-related data using data lake approach. This would enable single source of truth, enhance data accuracy, and simplify data maintenance.
- Technology transformation:** It is important that FIs work towards transforming their MRM technology infrastructure. This is imperative to enhance systems performance, reduce complexity, and improve reusability (for example, between similar risk functions such as SA-FRTB and ISDA SIMM, or amongst the various front office micro services). To achieve this transformation, FIs need to make strategic investments in new-age digital technologies such as AI, ML, RPA, NLP, graph and predictive analytics, big data, cloud, and microservices-based architecture. Refer below some of the key MRM capabilities that these digital technologies can enable for FIs.

In-depth, holistic, and near-real time insights	<ul style="list-style-type: none"> For example, in volatility forecasting; liquidity and cash flow forecasting; sensitivity analysis; analysis of macroeconomic fluctuations and associated impacts; intraday analysis of firm-wide market risks; interest rate curve forecasting; assets correlation; and asset pricing — by using ML techniques such as SVM, RRL, NN, GARCH, LSTM, GMM, integrating RNNs with stochastic volatility models etc. Predict market volatility based on news sites, public discussion board etc. — using NLP, and ML techniques such as SVR, Naive Bayes algorithm etc. Enable automated early-warning indicators that pull in a variety of economic, market, and customer data
Risk optimization	<ul style="list-style-type: none"> For example, in VaR modeling; portfolio risk optimization; funding and hedging strategy optimization; collateral optimization; balance sheet risk optimization; and optimization of liquidity reserves — by using ML techniques such as CNN, RNN, LSTM etc. Enable sophisticated liquidity risk scoring; liquidity buffer “switch tools” (for optimizing the treasury portfolio for risk and return); and pricing of illiquid securities (by establishing linkages with other liquid securities that have similar characteristics) Support margin valuation adjustment (MVA) and initial margin reduction for derivatives (through off-setting strategies, novating trades from one portfolio to another, etc.) Enhance cloud-based risk compute capacity (e.g., for SVaR computation)
Risk models and data process support	<ul style="list-style-type: none"> Support real-time monitoring and testing of models (using RPA); simulation for model tuning (using ML); and enable sophisticated modeling tools Identify data inconsistencies and fat-finger errors; interpolate and auto-populate missing data; and enable automated data aggregation and validation
Intelligent automation	<ul style="list-style-type: none"> Using RPA, ML and NLP to automate risk controls; and enable smart workflow, dynamic and real-time risk monitoring, trading limits monitoring, daily trade explanation, market rate and curve auto-validation etc. Utilizing AI-powered optical character recognition (OCR) engine to scan documentation and quickly determine the optimal collateral to post Quickly run routine and complex scenarios; replace sample validation with full scenario, instrument, currency etc. validation
Dashboard and reporting	<ul style="list-style-type: none"> Enable dynamic and real-time risk dashboards; digital treasury dashboards; visualization tools; and reports on market risk exposure, VaR, liquidity risk etc.

Refer figure 6 for an illustrative digital MRM solution functional architecture.



Figure 6: Illustrative digital MRM solution functional architecture

Digital MRM Solution Examples	
RiskSpan Edge Platform^{9,10}	
<ul style="list-style-type: none"> o Is a cloud-based data management, analytics and portfolio risk management solution for securities and loans. It offers comprehensive data analysis, predictive modeling, and portfolio benchmarking and reporting capabilities o Supports best-practice quant design for mortgage-backed securities, structured products, and loans o Leverages ML capabilities and enables the integration of conventional and alternative data from array of sources 	
Axioma Risk¹¹	
<ul style="list-style-type: none"> o Cloud-based portfolio risk management platform — offers buy-side firms a flexible and scalable solution for multi-asset class investment o Accurately captures the non-linear risk; and possesses over 120 different pricing models spanning several financial instruments o Offers factor-based risk decomposition across instruments with fixed income and equity risk 	
Nasdaq Risk Platform¹²	
<ul style="list-style-type: none"> o Is a real-time single multi-asset cloud-based risk platform for the sell-side and clearing brokers o Its flexible and open risk aggregation framework enables effective integration of risk models and market data sources o The platform offers a) counterparty risk controls, visibility into initial margin, and better risk-adjusted outcomes across asset classes; b) global 24/7 multi-asset coverage across derivatives, equities, and commodities; c) real-time exchange margin replication, and exposure, position, and P&L calculations; d) real-time VaR, scenario analysis and stress testing for market risk; e) historical and real-time market data services 	

Glossary of terms

A structured approach is crucial for effective implementation

In several ways, market risk function is an FI's nerve center. Further, in recent years, market risk has witnessed heightened complexities owing to increased interconnectedness and globalization, evolution of the trading ecosystem, technological advances, and several key regulatory changes. The onset of COVID-19 has further increased the challenging for firms.

To effectively manage their market risks now and in the future, FIs need to work on the four dimensions mentioned above. Importantly, firms need to adopt a structured approach — they must prioritize the key high-impact opportunities that can deliver tangible returns in near future. Such short-term wins would help firms enthuse the concerned teams and convince key decision makers to allocate more resources for the larger MRM transformation undertakings.

Similarly, with regards to digitalization, FIs should start with making key tactical investments that can bring in immediate benefit — for example, in areas that currently require significant manual intervention and where improving speed and quality of decision making is crucial.

Importantly, firms must make prudent “in house versus outsourcing” decision. In areas where an FI lacks the required MRM technology and domain capabilities, it should engage, through strategic partnerships, the relevant best-of-breed solution providers and FinTechs to support their digital transformation journey.

Acronym	Expansion
AI	Artificial Intelligence
ALM	Asset and Liability Management
AUM	Assets Under Management
CNN	Convolutional Neural Network
CRR	Cash Reserve Ratio
CVA	Credit Valuation Adjustment
DVA	Debit Valuation Adjustment
ES	Expected Shortfall
EWI	Early Warning Indicator
FDIC	Federal Deposit Insurance Corporation
FI	Financial Institution
GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GDP	Gross Domestic Product
GMM	Gaussian Mixture Model
IMF	International Monetary Fund
ISDA-SIMM	International Swaps and Derivatives Association Standard Initial Margin Model
LST	Liquidity Stress Testing
LSTM	Long Short-Term Memory

Acronym	Expansion
ML	Machine Learning
MRM	Market Risk Management
MTM	Mark to Market
MVA	Margin Valuation Adjustment
NLP	Natural Language Processing
NN	Neural Network
OCR	Optical Character Recognition
P&L	Profit and Loss
RNN	Recurrent Neural Network
RPA	Robotic Process Automation
RRL	Recurrent Reinforcement Learning
RWA	Risk-Weighted Assets
SA-FRTB	Standardized Approach Fundamental Review of the Trading Book
SLR	Statutory Liquidity Ratio
SVaR	Stressed Value at Risk
SVM	Support-Vector Machine
SVR	Support Vector Regression
VaR	Value at Risk
XVA	X-Value Adjustment
YOY	Year-Over-Year



About the Authors



Anjani Kumar

Principal Consultant; Global Risk, Regulatory Tech, and Computational Finance Practices; Financial Services Domain Consulting Group, Infosys Limited

Anjani has over 20 years of comprehensive IT, domain, and process consulting experience. Currently, he manages and supports several strategic programs including Thought Leadership, Solution Enablement, Research, and Competency Development. He is an accomplished thought leader and has large number of whitepapers and point of views published on reputed external websites.



Rajan Gupta

Senior Consultant, Computational Finance Practice, Financial Services Domain Consulting Group, Infosys Limited

Rajan has 14 years of experience across business analysis and project management. He has worked extensively in risk management area, which includes IT implementation and requirements management in credit risk, market risk and treasury. He has offered trainings and published whitepapers and PoVs in the risk management domain.

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For more information, contact askus@infosys.com



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