**Regulatory Compliance Memo: FRTB Impact Assessment for Market Risk Analytics Project**

**To:** Head of Market Risk Management

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**Subject:** Assessment of Market Risk Analytics Project Components against FRTB Requirements

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# 1. Executive Summary

This memo assesses the alignment of our Python-based Market Risk Analytics project's capabilities with the Fundamental Review of the Trading Book (FRTB) framework. The project successfully implements core market risk metrics (VaR, ES), scenario analysis, stress testing, and basic backtesting, providing a foundational quantitative toolkit. While a full FRTB implementation is highly complex and requires significant infrastructure, this project demonstrates a strong conceptual and practical understanding of key FRTB principles, particularly those relevant to the Internal Model Approach (IMA).

# 2. Project Components and FRTB Alignment

## 2.1 Expected Shortfall (ES) Calculation

* **FRTB Requirement:** FRTB mandates Expected Shortfall (ES) at a 97.5% confidence level over a 10-day horizon for the Internal Model Approach (IMA) capital charge.
* **Project Alignment:** Our project calculates Historical, Parametric, and Monte Carlo CVaR (which is synonymous with ES) at a user-defined confidence level (currently 99%).
* **Gap Analysis / Next Steps:**
  + **Confidence Level:** Adjust the confidence level to 97.5% for direct FRTB IMA calculation.
  + **Horizon:** The current calculations are for a 1-day horizon. For FRTB, ES needs to be scaled to a 10-day horizon. This typically involves scaling daily ES by the square root of time (for independent returns) or, more accurately, by re-calculating ES over 10-day historical/simulated returns.
  + **Risk Factors:** ES must be calculated for all risk factors identified by the bank's internal models, including interest rates, equities, FX, commodities, and credit spread risks. Our current model covers equities; expansion to other asset classes is a critical next step.

## 2.2 Backtesting Framework

* **FRTB Requirement:** FRTB requires rigorous backtesting of ES models to ensure their accuracy. While specific ES backtesting tests are still evolving, the framework emphasizes both unconditional coverage (frequency of exceptions) and conditional coverage (independence of exceptions).
* **Project Alignment:**
  + **VaR Backtesting:** Implements Kupiec's Proportion of Failures (POF) test, a foundational unconditional coverage test for VaR.
  + **CVaR Backtesting:** Includes a qualitative Average Exceedance Test, comparing actual average losses on VaR breach days to predicted CVaR.
* **Gap Analysis / Next Steps:**
  + **Formal ES Backtesting:** Implement more advanced statistical tests specifically designed for ES, which consider both the frequency and magnitude of tail losses (e.g., conditional coverage tests, magnitude-based tests).
  + **Rolling Window:** Implement a rolling window approach for VaR/ES calculation and backtesting, as required by FRTB to reflect current market conditions and model performance over time.
  + **Traffic Light System:** Integrate a "traffic light" system (green, yellow, red zones) for backtesting results, as used by regulators to assess model performance and potential capital add-ons.

## 2.3 Stress Testing and Scenario Analysis

* **FRTB Requirement:** FRTB mandates comprehensive stress testing to capture risks not adequately covered by ES, particularly for non-modellable risk factors and severe market events.
* **Project Alignment:** Our project includes a framework for defining and applying various stress scenarios (e.g., general market downturns, sector-specific shocks, historical crisis replications like 2008 GFC and COVID-19). It quantifies the potential loss under each scenario.
* **Gap Analysis / Next Steps:**
  + **Granularity:** Expand scenarios to cover a wider range of market risk factors (interest rates, FX, credit spreads, volatility surfaces) and their interdependencies.
  + **Factor-Based Stressing:** Move towards factor-based stress testing, where shocks are applied to underlying risk factors rather than directly to asset prices.
  + **Reverse Stress Testing:** Develop capabilities for reverse stress testing to identify scenarios that could lead to a specific, unacceptable level of loss for the firm.

## 2.4 Non-Modellable Risk Factors (NMRF)

* **FRTB Requirement:** FRTB introduces a capital charge for NMRFs – risk factors for which there are insufficient observable market prices to reliably model their behavior.
* **Project Alignment:** Our current project does not explicitly identify or calculate capital for NMRFs.
* **Gap Analysis / Next Steps:** Develop a methodology to identify NMRFs within the portfolio and implement a capital charge calculation for them, as per FRTB guidelines. This would involve assessing data availability and liquidity for each risk factor.

## 2.5 Default Risk Charge (DRC)

* **FRTB Requirement:** FRTB introduces a separate capital charge for default risk in the trading book, covering both idiosyncratic and jump-to-default risks.
* **Project Alignment:** Our current project focuses on market price risk.
* **Gap Analysis / Next Steps:** Integrate a component for calculating the Default Risk Charge, which would involve credit risk modeling (e.g., probability of default, loss given default, exposure at default for trading book instruments).

## 2.6 P&L Attribution (PLA)

* **FRTB Requirement:** FRTB requires a P&L Attribution test to ensure that the risk factors used in the internal risk model adequately explain the daily P&L of the trading desk.
* **Project Alignment:** Our current project does not include PLA.
* **Gap Analysis / Next Steps:** Implement a PLA framework to compare theoretical P&L (from risk factor changes) with actual P&L, identifying any unexplained P&L.

# 3. Conclusion

The Market Risk Analytics project serves as a robust quantitative foundation, demonstrating key skills in market risk measurement and validation. Its current capabilities directly support several core aspects of FRTB, particularly the ES calculation, backtesting, and stress testing components for IMA. Future enhancements, as outlined above, will be critical to achieving full FRTB compliance and strengthening the bank's market risk management capabilities.

This project provides a valuable practical demonstration of the knowledge and skills required for a Quant Analyst role focused on market risk and FRTB.