Stress Test Design: Market Risk

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We Know That …

• Trading book risk profile changes continuously

• **Liquid risks** move in and out rapidly, directional exposures tend to be small, non-linear risks are managed dynamically

• **Illiquid risks** can cause large losses especially when related to non-linear and wrong-way risks

• Credit products and counterparty risks caused large trading losses in 2008 crisis

• Crisis dynamics and systemic risks are very important
Design Elements

- Liquidity of the risks
- Reverse stress test
- Probability of the stress test
- Counterparty risk
- Endogenous crisis dynamics
Liquidity

Key elements to capture

• Liquid market risks tend to move fast

• Illiquid risks don’t move fast; they can cause large losses that accumulate over extended periods

Recommendation

• Stress test needs to differentiate the liquidities of the risks

• Liquid risks: small shocks

• Illiquid risks: large shocks

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The problem with large shocks to liquid risks

Suppose that the trading positions and stress test shocks are:

- Long $200mm ABS, stress shock \(-35\%\)
- Short $100mm WTI, stress shock \(-70\%\)

Stress Test Results

- ABS loss \(-$70mm\)
- WTI gain \(+$70mm\)
- The NET stress test result is \textbf{ZERO}

In reality, the WTI position is liquid and it is likely to be closed quickly. The ABS position is illiquid and it cannot be hedged, the bank is likely to lose \textbf{-$70mm}

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Another issue with large shocks to liquid risks

Continuous delta-hedging of liquid risks will adjust the risk profile over time and the positive convexity gains will not be realized.
Systematic Reverse Stress Test

Key elements to capture

- Market prices respond to ‘news’
- Price changes may not directly relate to the current macroeconomic environment
- Directional trading risks are mostly hedged
- Residual basis risks may be difficult to identify \textit{ex ante}

Recommendation

- Systematic reverse stress test with multiple and innovative scenarios
- At a minimum, up/down shocks in each risk class to capture the risks of short/long positions

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Probability

Key elements to capture

- It is useful to have a measure of the probability (severity) of the stress test
- To inform risk analysis
- To inform risk management actions

Recommendation

- Stress test scenarios should be associated with some notion of their probability
Counterparty Risk

Key elements to capture

- Complex, non-linear risks: \( \text{CVA} = (\text{Exposure}) \cdot (\text{Spread}) \)
- Sometimes the risks are wrong way and illiquid
- Dynamic hedging costs can be large, especially in volatile and illiquid market

Recommendation

- Mark-to-market stress test (price shocks)
- Jump-to-default stress test (IDR)
- Hedging-cost stress test (simulations of hedging strategies)

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Endogenous Dynamics

Key elements to capture

- Endogenous market dynamics during market crises are difficult to forecast
- De-risking, de-leveraging, fire sales, connectedness, contagion, etc…
- Those dynamics may be a key determinant of the severity of market crises

Recommendation

- Need to understand the accumulation of systemic risks
- This is difficult for any single institution to achieve by itself
- Data aggregation and network analysis

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