Simulating liquidity stress in the derivatives market

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Background

- Derivative contracts are increasingly collateralised
  - Less counterparty credit risk
  - But risk of liquidity strains when large collateral calls?
- Two main sources of collateralisation
  - Variation margin (VM): offsets changes in exposure due to daily price movements
  - Initial margin (IM): offsets potential exposures (mainly collected at outset of trades)
Basic idea

- Scenario: shock to risk factors, e.g. interest rates and exchange rates
- Values of derivative contracts change
  - Counterparties on the ‘wrong’ side of changes get VM calls from those on the ‘right’ side
- Institutions can meet VM calls with their cash buffers and any cash inflows from VM payments to them
- Institutions that are not able to meet VM calls in full need to take some defensive action, e.g. borrow in repo market or liquidate assets
  - These defensive actions impose costs on others (‘externalities’)

▪ Counterparties on the ‘wrong’ side of changes get VM calls from those on the ‘right’ side
Model schematic

2018 US bank stress test
‘severely adverse’ scenario

Scenario
(changes in interest
and FX rates)

DV01s
(valuation sensitivity
formulae)

Valuation
changes
(per contract)

Derivative
portfolios
(between institutions)

Liquid-asset
buffers

Variation margin
obligations

Payment
algorithm

Liquidity
shortfalls
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(changes in interest and FX rates)

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Liquidity shortfalls

c. 100 cleared portfolios
c. 8k non-cleared portfolios
Portfolio coverage

- DTCC and Unavista data
- At least one UK counterparty
- As of end-Sept 2017
- 3m outstanding trades
Scenario
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Derivative portfolios
(between institutions)

Three metrics

Liquid-asset buffers

Variation margin obligations

Payment algorithm

Liquidity shortfalls

Cleared: rates = $96bn, FX= $1bn
Non-cleared: rates = $46bn, FX $177bn
Liquid asset buffers (LAB)

- Total LABs
  - Reserves and demand deposits
- Derivatives share of total LABs
  - \((\text{Total LAB}) \times (\text{Fraction of LCR for derivatives outflows})\)
- Derivatives share of excess LABs
  - \((\text{Excess LAB over LCR}) \times (\text{Same fraction})\)

Alternative LAB metrics

<table>
<thead>
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<th>Metric 1: Total LABs</th>
<th>Metric 2: Derivatives share of total LABs</th>
<th>Metric 3: Derivatives share of excess LABs</th>
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<td>US$ billions</td>
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Focus here
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Liquidity shortfalls
Payment algorithm

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  - CMs that have enough cash to make a full payment will pay
  - CMs that don’t have enough cash to make a full payment will wait
Payment algorithm

- Nobody in this triangle can make a full payment, so they all end up borrowing

- We break the shortfalls into three components:
  - **Domino**: Shortfall only because counterparties did not pay
    - (1) **Avoidable**: A central authority could direct loops of (partial) payments
    - (2) **Unavoidable**: No such loops
  - (3) **Fundamental**: Shortfall even if all counterparties had paid in full
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Liquidity shortfalls
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Liquidity shortfalls at different corporate groups

- Versus daily cash borrowing in USD + EUR + GBP repo markets = c. $650 billion
Summary

- Toolkit for simulating liquidity shortfalls due to margin calls
  - Present: liquidity shortfalls appear manageable
  - Future: useful to monitor risk by periodically updating simulations

- With further calculations, our toolkit also shows
  - Who contributes most to aggregate liquidity shortfalls
  - Effect of market structure changes on potential shortfalls

- Toolkit could be enhanced with
  - Additional scenarios
  - Additional derivative types (but increasingly complex to value)
  - Additional counterparties (but raw data in other jurisdictions)