BANK OF ENGLAND

8th Policy Research Workshop
European Banking Association
27 November 2019

Simulating liquidity stress in the derivatives market

Marco Bardoscia, Gerardo Ferrara, Nicholas Vause, Michael Yoganayagam

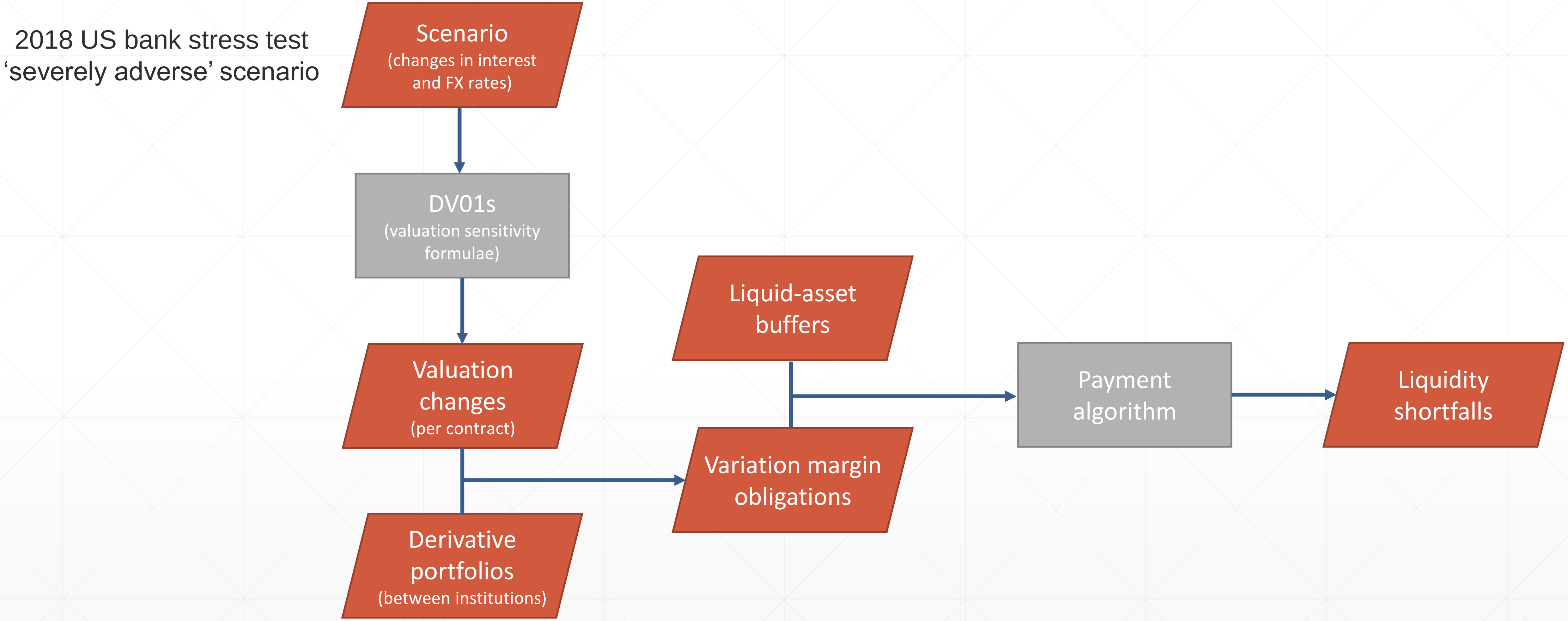
Background

- 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’)

Model schematic



Scenario

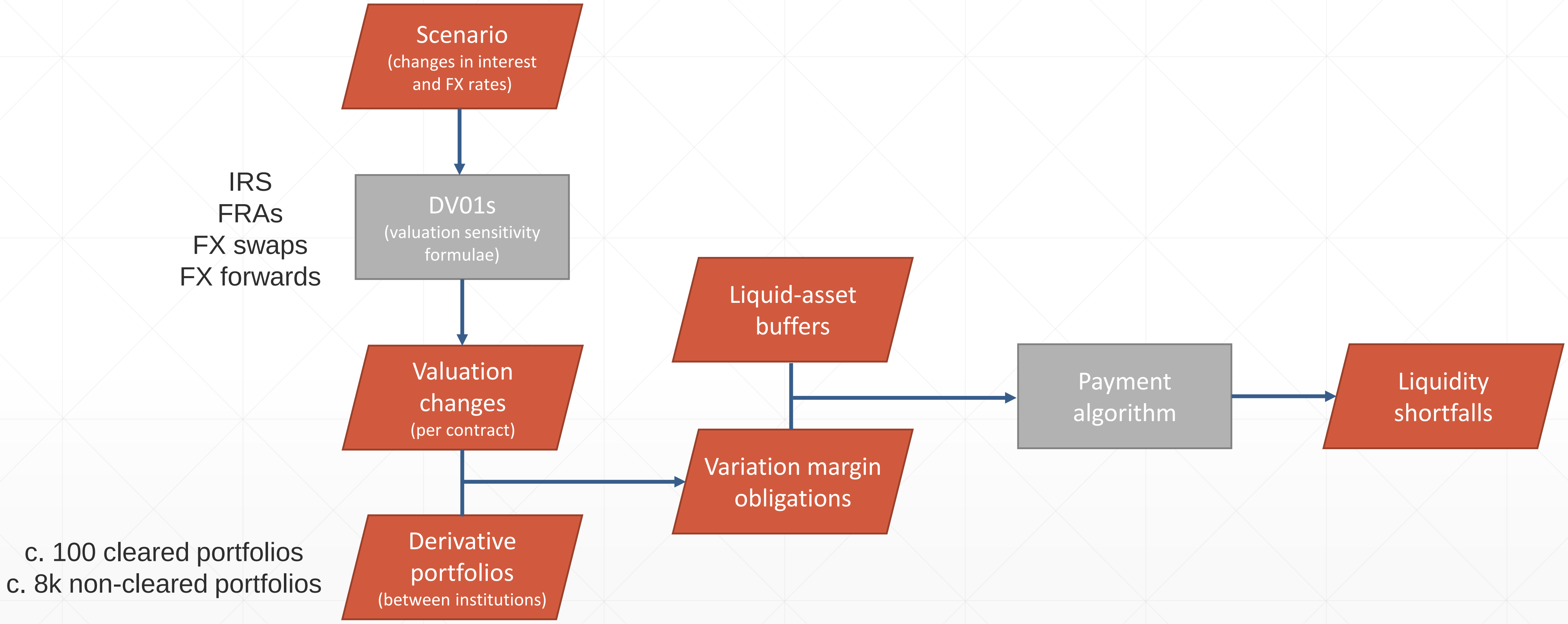
Changes in main swap rates (basis points)

Currency	Residual maturity (months): 1	3	6	9	12	24	36	60	84	120	180	240	360
EUR	-16	-18	-19	-21	-22	-24	-24	-22	-19	-16	-13	-12	-11
USD	28	39	54	71	85	115	141	175	187	191	193	194	196
GBP	-24	-23	-22	-22	-21	-20	-20	-19	-17	-14	-13	-11	-6
AUD	-18	-21	-25	-29	-31	-38	-40	-40	-37	-36	-36	-37	-39
JPY	-9	-10	-11	-11	-12	-15	-16	-16	-16	-17	-17	-18	-20
CAD	42	44	52	57	60	65	72	87	92	92	87	82	76

Changes in main FX rates (%)

Base currency	Quote currency: EUR	USD	GBP	AUD	JPY	CAD
EUR						
USD	2.2					
GBP	-1.6	15				
AUD	-9.8	5.3	-8.4			
JPY	14.1	13.8	-1.1	7.5		
CAD	-5.4	10.5	-3.9	4.7	-2.9	

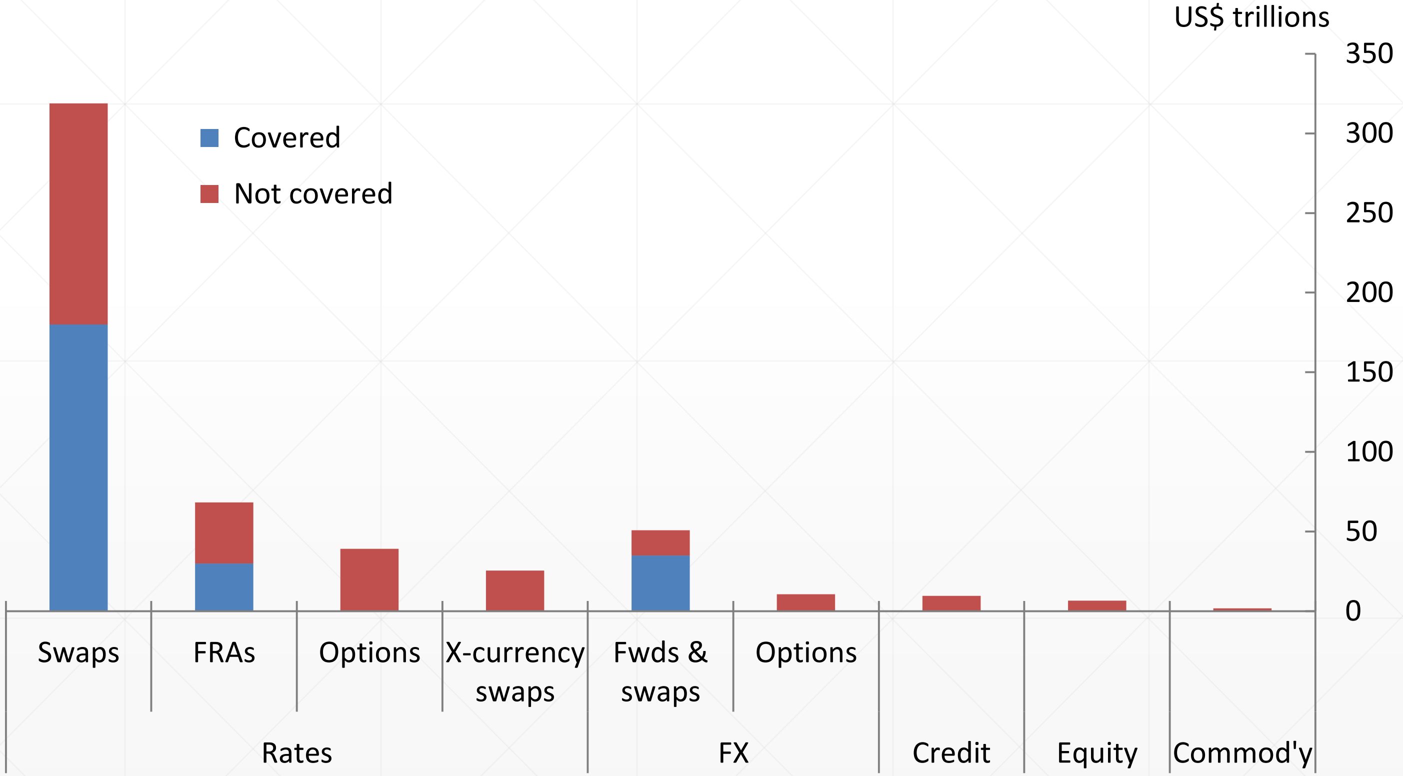
Model schematic



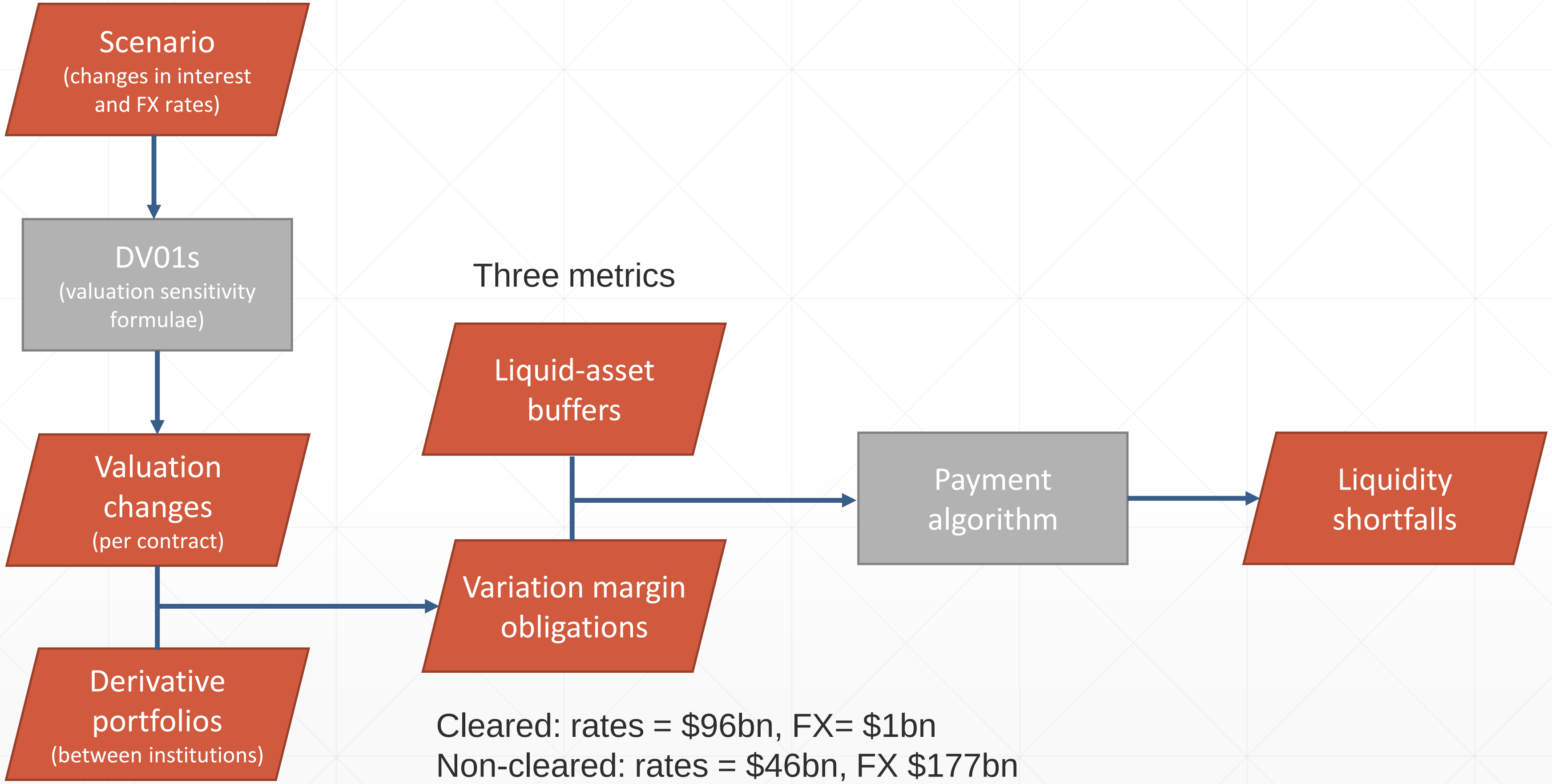
Portfolio coverage

- DTCC and Unavista data
- At least one UK counterparty
- As of end-Sept 2017
- 3m outstanding trades

Global notional amounts covered / non covered in analysis

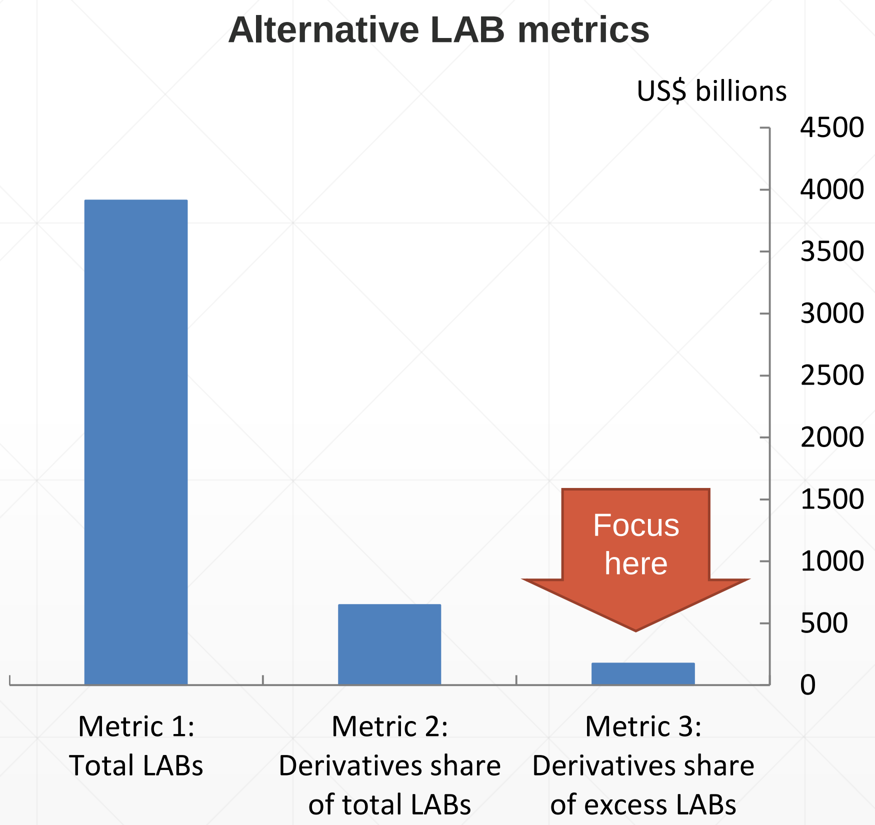


Model schematic

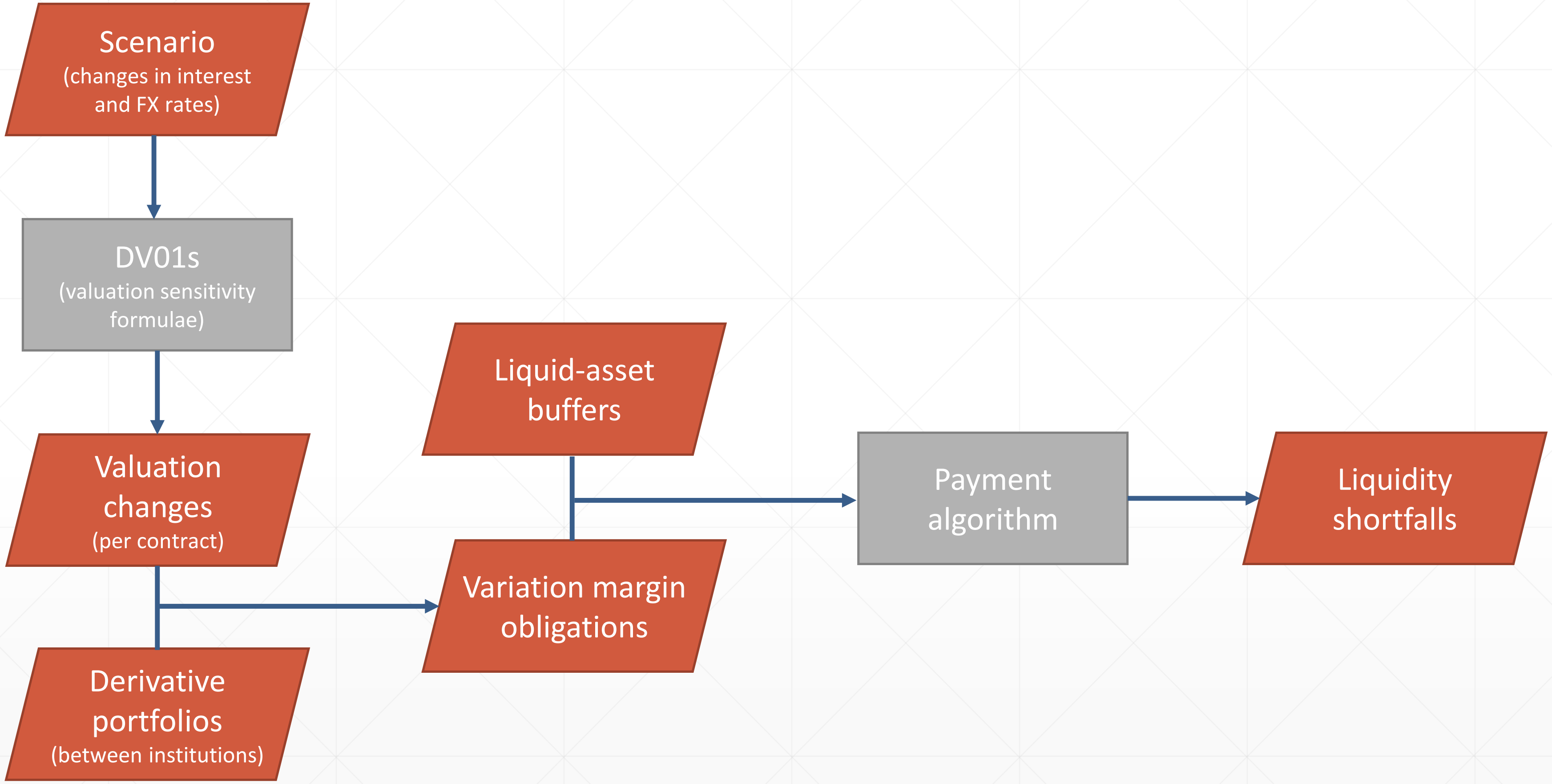


Liquid asset buffers (LAB)

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

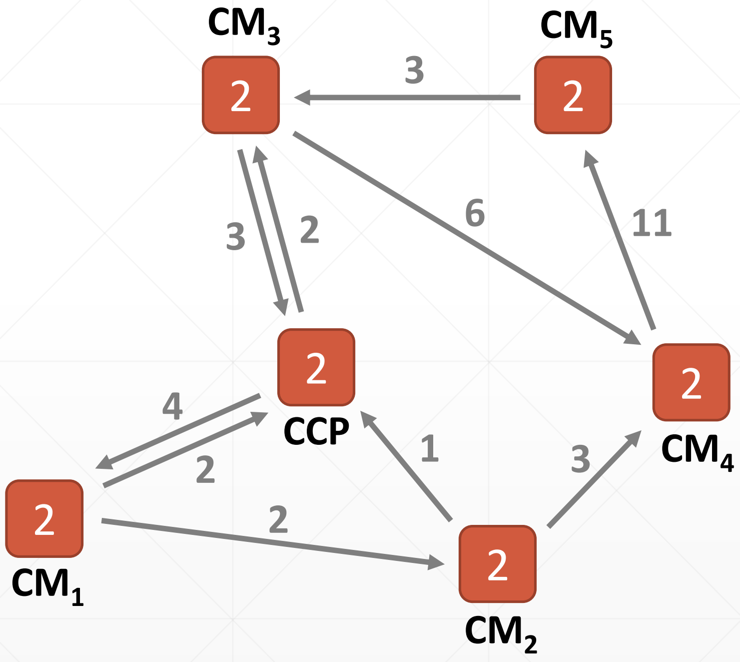


Model schematic



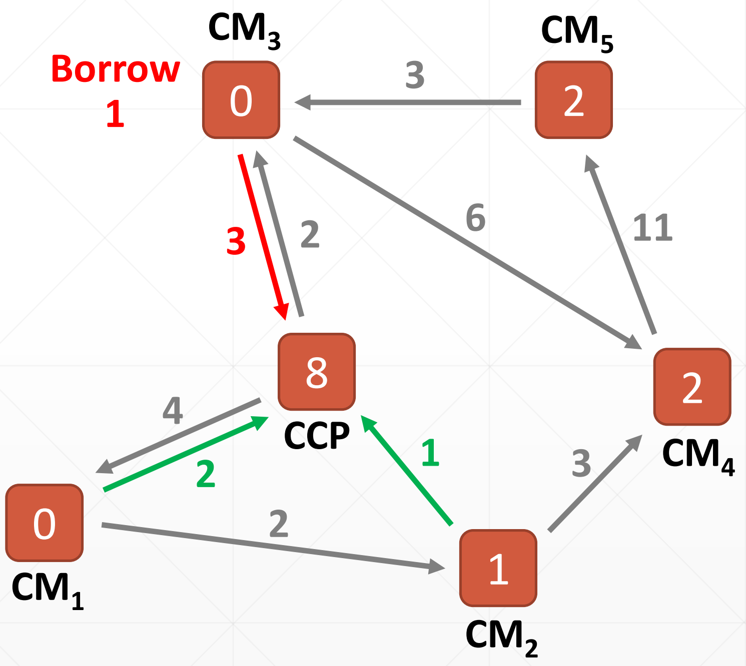
Payment algorithm

- *t = 0* (9:00 AM): payments to the CCP are due



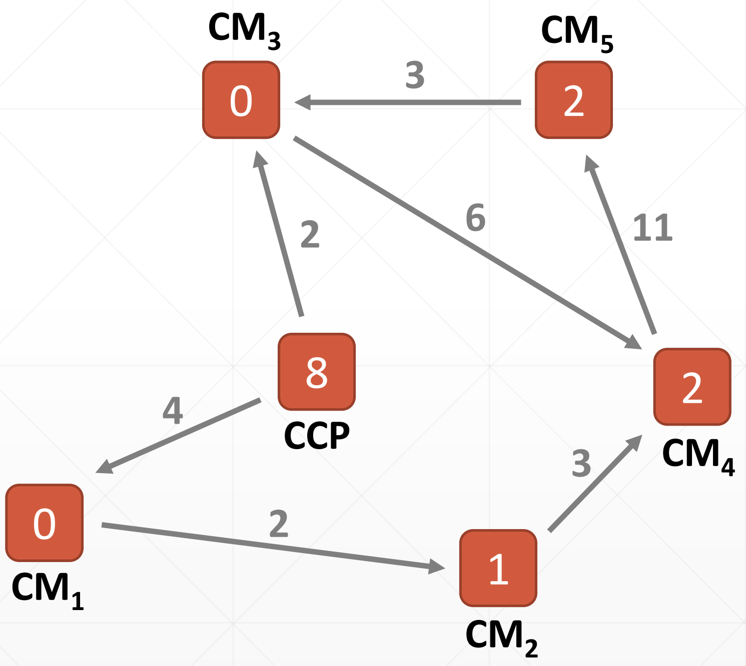
Payment algorithm

- *t = 0* (9:00 AM): payments to the CCP are due



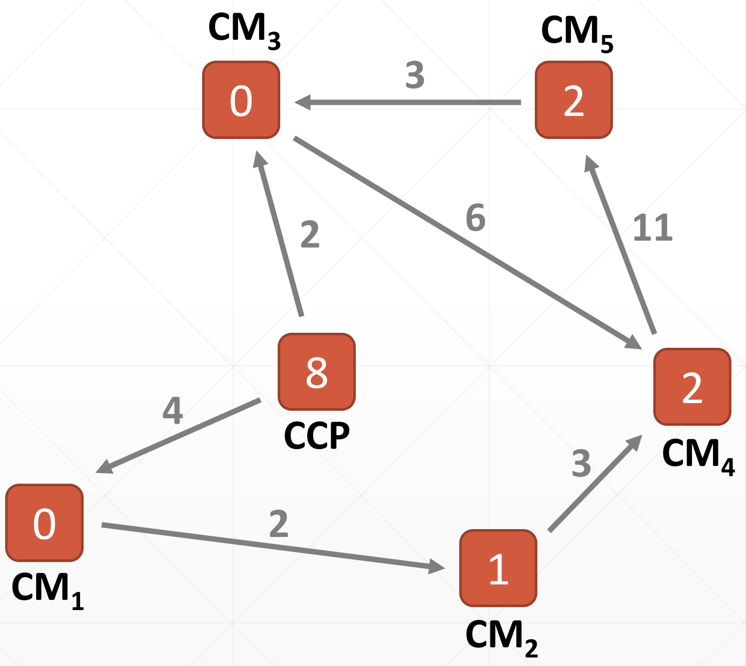
Payment algorithm

- *t = 0* (9:00 AM): payments to the CCP are due



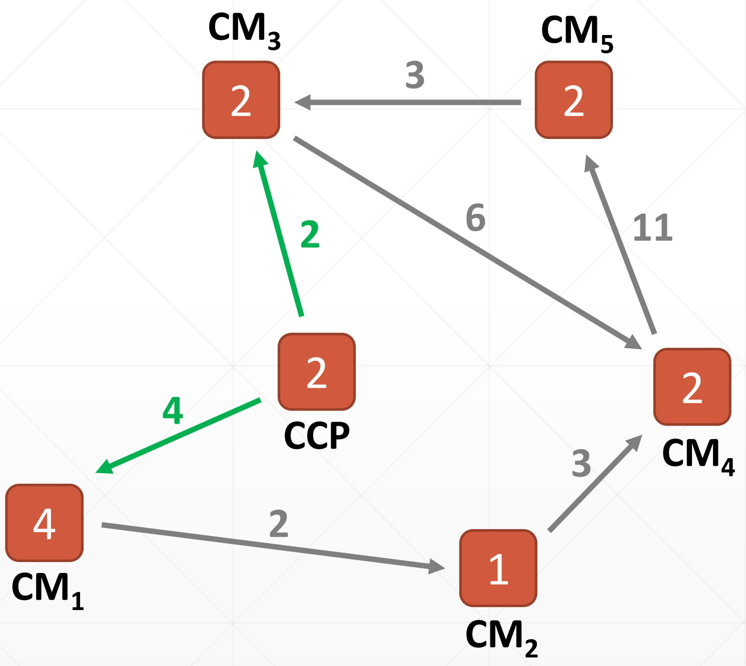
Payment algorithm

- *t = 0* (9:00 AM): payments to the CCP are due
- *t = 1* (9:30 AM): the CCP pays its CMs



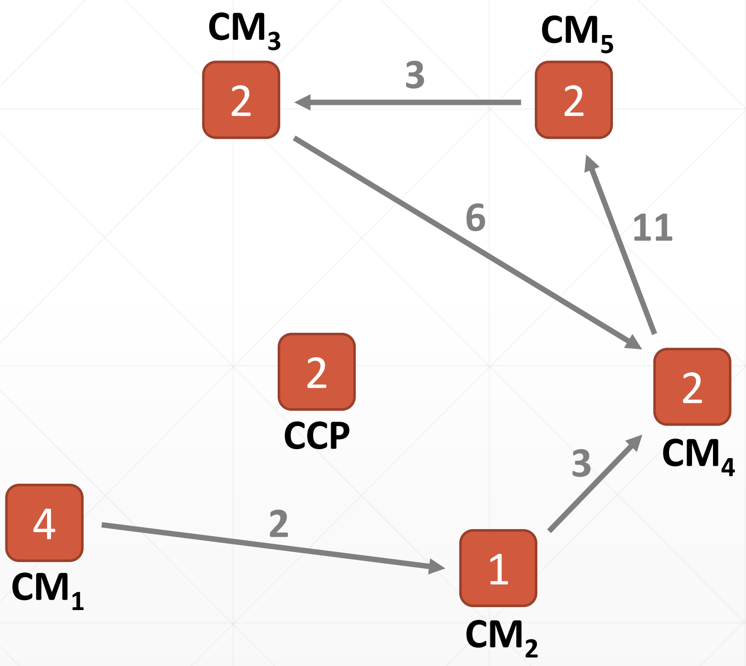
Payment algorithm

- *t = 0* (9:00 AM): payments to the CCP are due
- *t = 1* (9:30 AM): the CCP pays its CMs



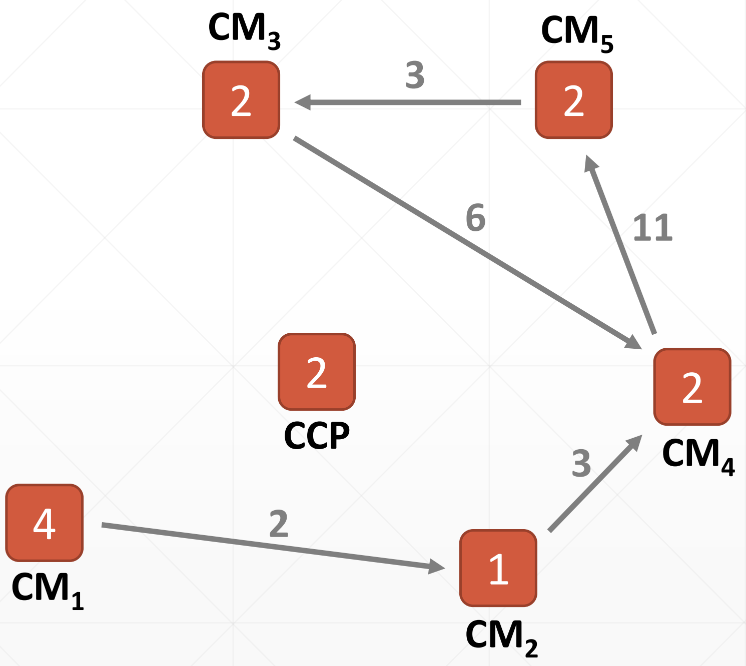
Payment algorithm

- $t = 0$ (9:00 AM): payments to the CCP are due
- $t = 1$ (9:30 AM): the CCP pays its CMs



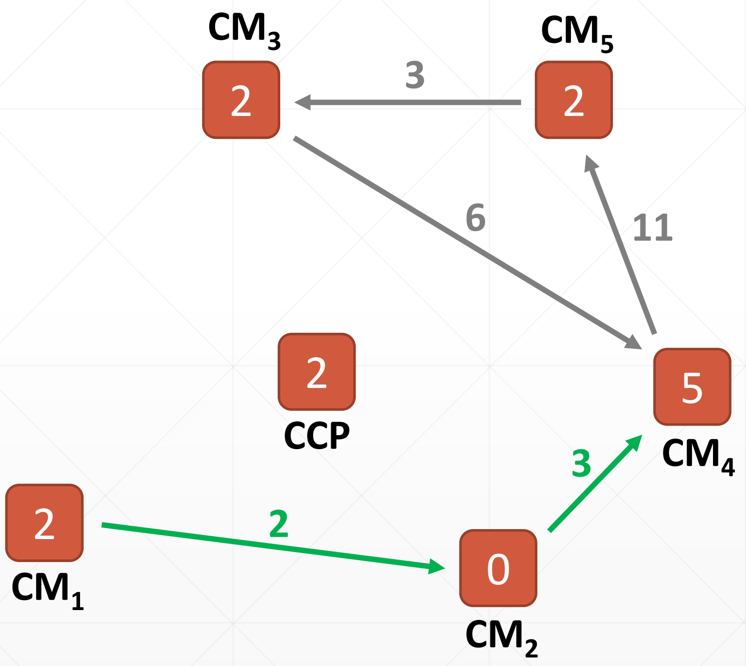
Payment algorithm

- *t = 0* (9:00 AM): payments to the CCP are due
- *t = 1* (9:30 AM): the CCP pays its CMs
- *t = 2* (until close of business): CMs settle bilateral VM calls



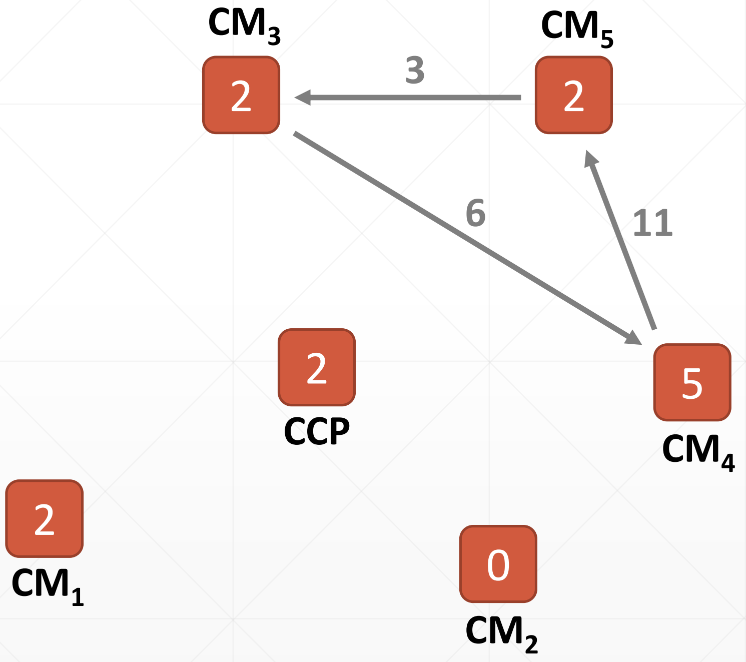
Payment algorithm

- *t = 0* (9:00 AM): payments to the CCP are due
- *t = 1* (9:30 AM): the CCP pays its CMs
- *t = 2* (until close of business): CMs settle bilateral VM calls
  - CMs that have enough cash to make a full payment will pay



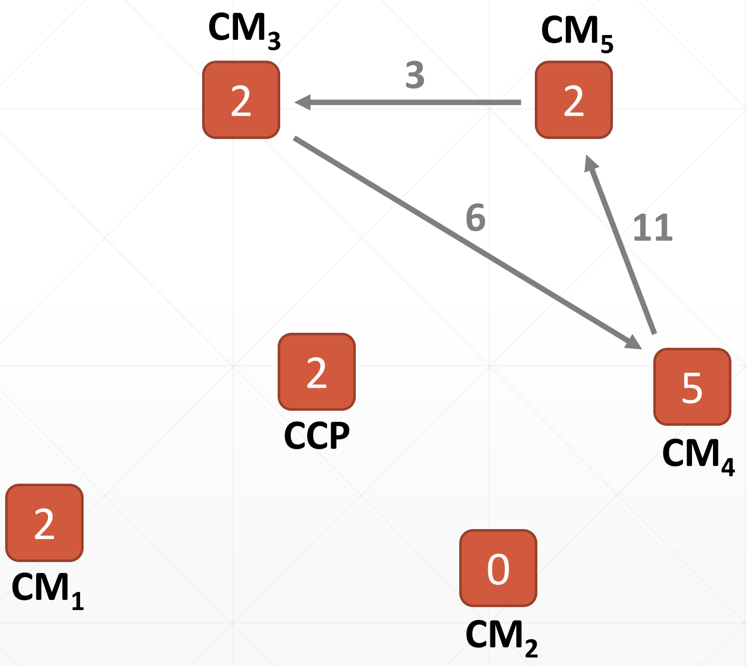
Payment algorithm

- *t = 0* (9:00 AM): payments to the CCP are due
- *t = 1* (9:30 AM): the CCP pays its CMs
- *t = 2* (until close of business): CMs settle bilateral VM calls
  - CMs that have enough cash to make a full payment will pay



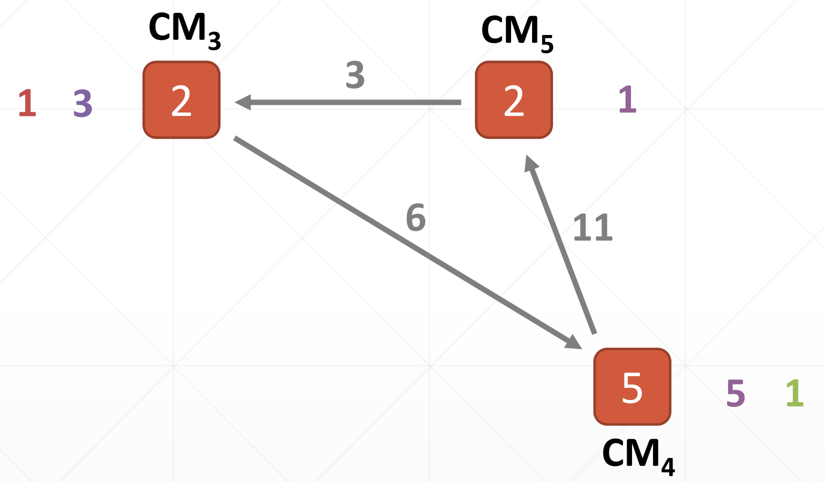
Payment algorithm

- $t = 0$ (9:00 AM): payments to the CCP are due
- $t = 1$ (9:30 AM): the CCP pays its CMs
- $t = 2$ (until close of business): CMs settle bilateral VM calls
  - 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

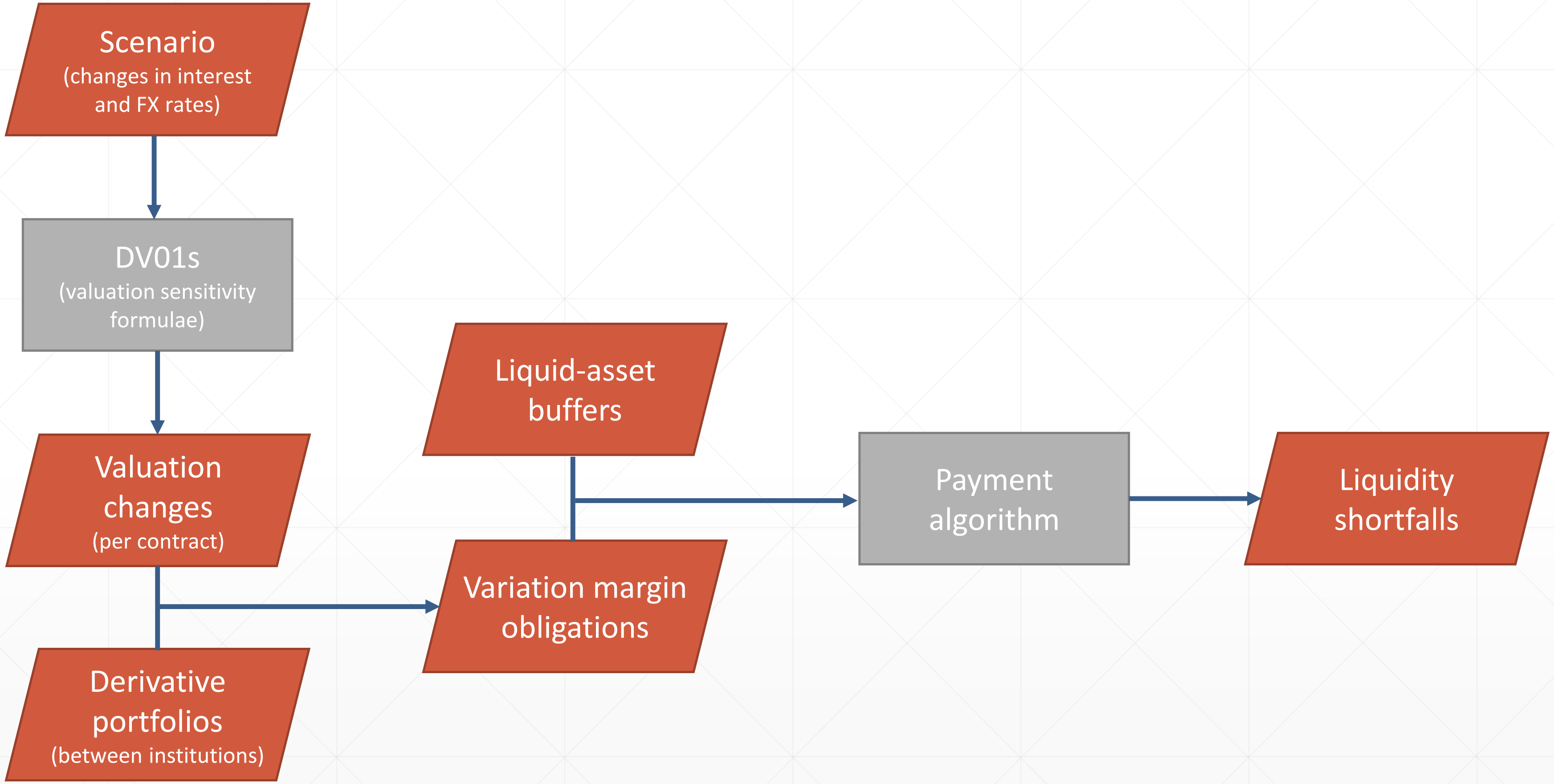


Payment algorithm

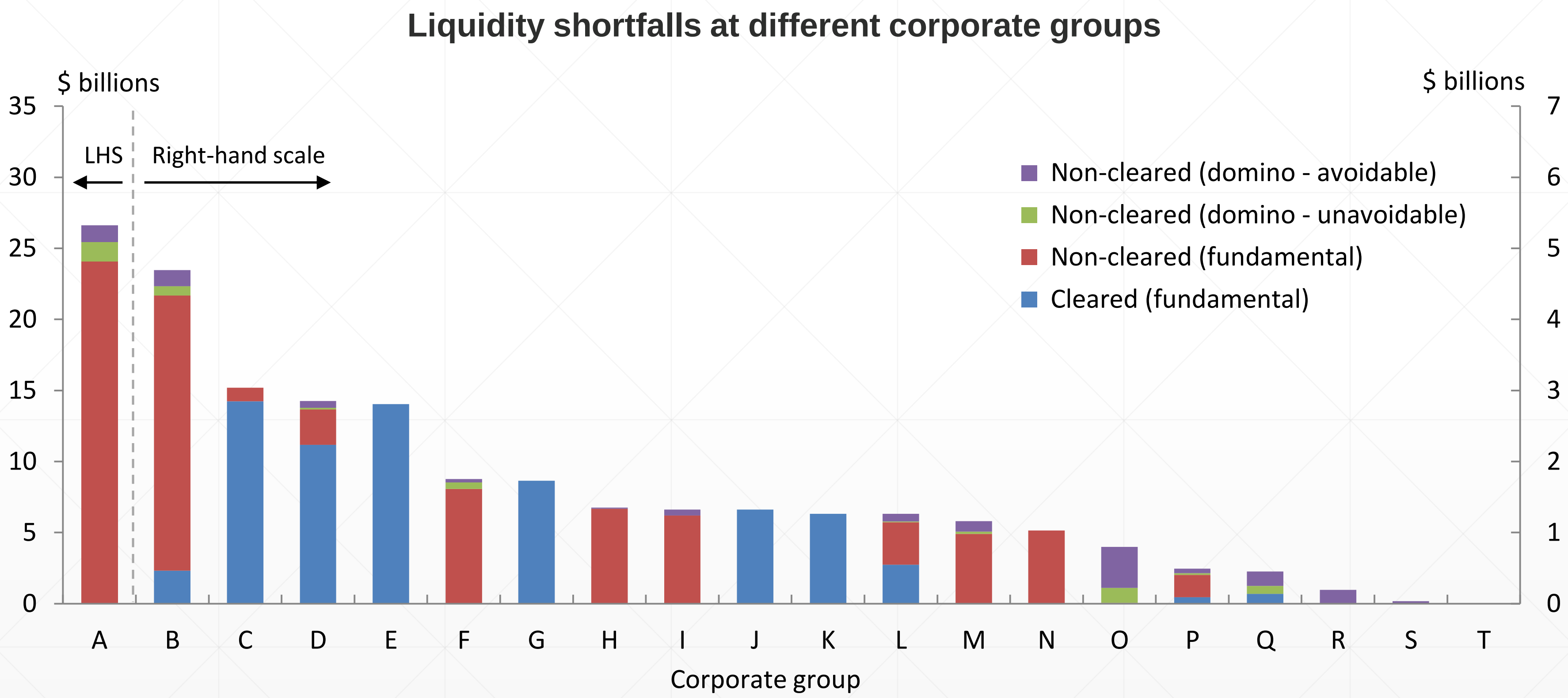
- Nobody in this triangle can make a full payment, so they all end up borrowing
- We break the shortfalls into three components:
  - **Domino:** Shortfall only because counterparties did not pay
    - **(1) Avoidable**: A central authority could direct loops of (partial) payments
    - **(2) Unavoidable**: No such loops
  - **(3) Fundamental**: Shortfall even if all counterparties had paid in full



Model schematic



Liquidity shortfalls



- 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)