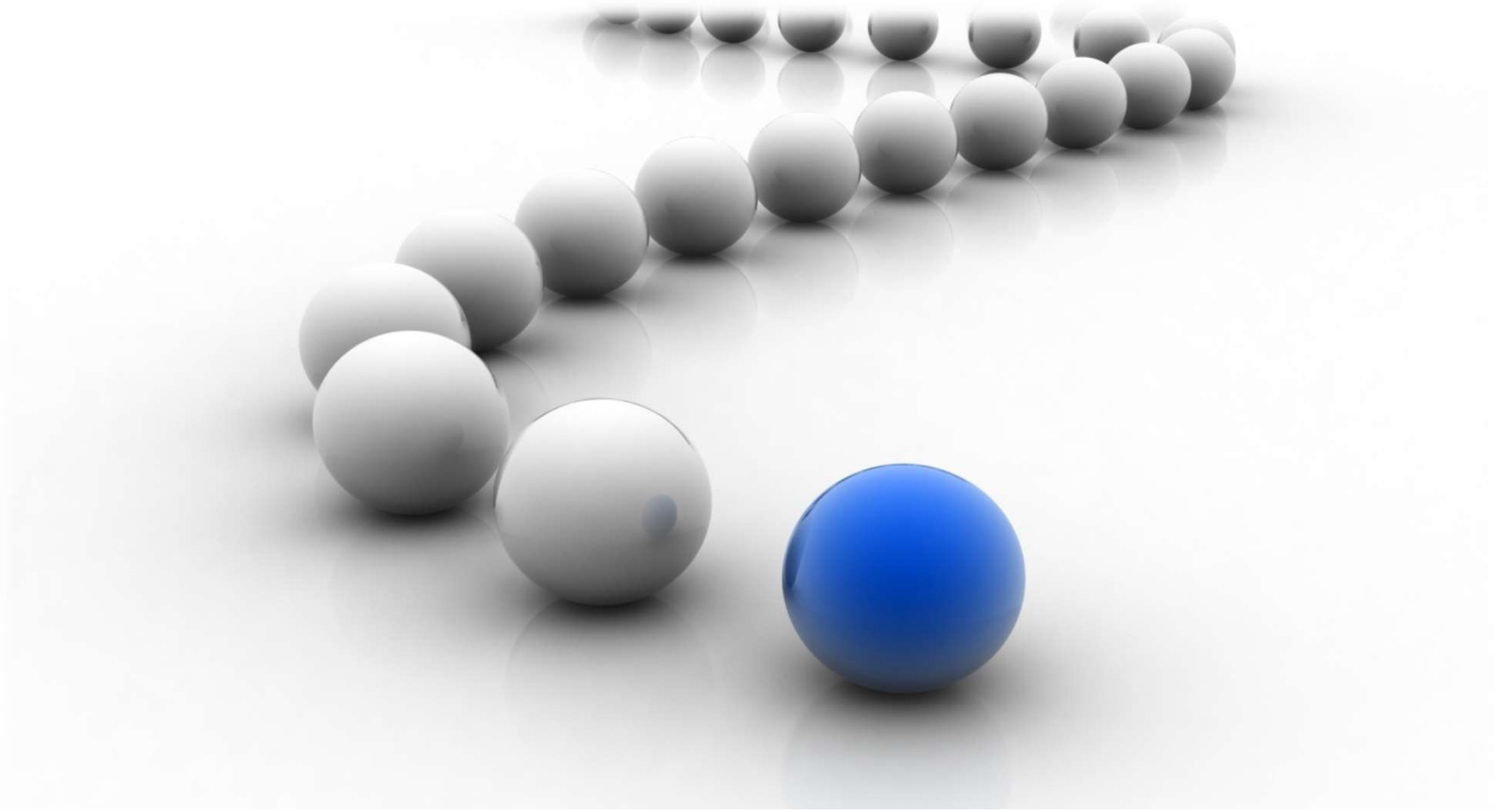


The Impact of Initial Margin

Jon Gregory

Working Paper

"The Impact of Initial Margin", available on SSRN

Introduction

Initial Margin Requirements

Structural Model Approach

Conclusion

Background (I)

- **OTC derivatives were generally seen as causing / contributing to the global financial crisis (2007 onwards)**
- **This has led to much regulation aimed at this market (and banks in general)**
- **Capital**
  - Fundamental review of the trading book
  - CVA capital charge
  - Leverage ratio*
- **Funding**
  - Liquidity coverage ratio*
  - Net stable funding ratio*
- **Collateralisation**
  - Clearing mandate
  - Bilateral margin requirements

* Not specific to OTC derivatives

Background (II)

- **Two of the regulatory mandates specific to OTC derivatives are based on increasing collateralisation in this market, namely**

- **The clearing mandate**
  - The requirement to centrally clear standardised OTC derivatives
- **The bilateral margin requirements**
  - The requirement to collateralise the non-clearable OTC derivative transactions more fully

- **Both of these initiatives require extensive initial margin posting by financial firms (note that end-users are generally exempt from these requirements)**
  - Initial margin (independent amount) is rare in bilateral OTC derivative markets

Why Initial Margin?

- **Clearing Mandate**

"*To reduce the systemic risks resulting from bilateral trading, the G20 Leaders agreed at the 2009 Pittsburgh Summit that all standardised derivatives contracts should be traded on exchanges or electronic trading platforms, where appropriate, and cleared through central counterparties (CCPs). CCPs had, indeed, proved resilient during the crisis, continuing to clear contracts even when bilateral markets had dried up..*"

BIS (2015)

- **Bilateral Margin Requirements**

"*The BCBS and IOSCO have evaluated the calculation of these baseline margin amounts by reference to the two underlying benefits of the margin requirements described in Part A – systemic risk reduction and promotion of central clearing.*"

BCBS-IOSCO (2014)

Introduction

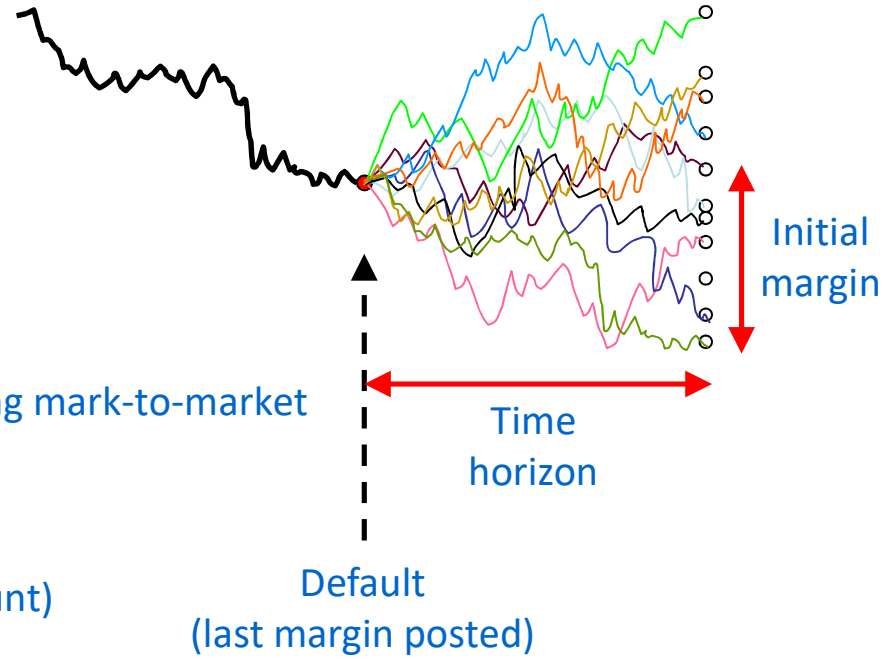
Initial Margin Requirements

Structural Model Approach

Conclusion

Collateral in OTC Markets

- **Variation margin**
  - Quite common between major OTC players
  - Represents a periodic adjustment of running mark-to-market
- **Initial margin**
  - Historically uncommon (independent amount)
  - Represents extra collateral
  - 99% confidence level (or more)
  - 5-day time horizon (CCP) or 10-day (bilateral)

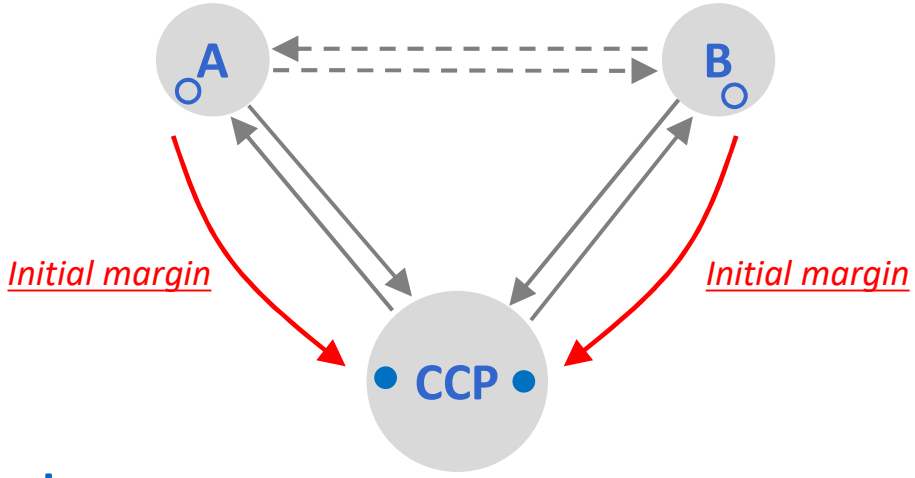


Initial Margin Represents Extra Collateral

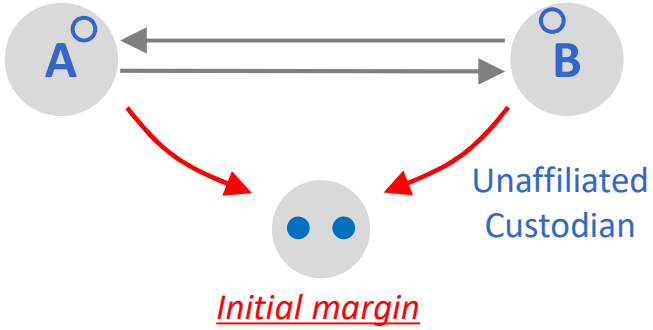
- **Unlike variation margin, initial margin represents overcollateralisation**
  - This means posted initial margin should potentially increase counterparty risk and associated capital requirements (CVA and KVA)
  - This has been demonstrated clearly in some large profile default events (e.g. Lehman Brothers and MF Global)
- **Segregation of initial margin is therefore important**
  - Segregation aims to ensure that a non-defaulting institution will never lose their initial margin
  - There are clearly legal and operational problems around segregation
  - Segregation is also expensive because it largely prevents the initial margin being used for investment and funding purposes

Mechanics of Segregated Initial Margin posting

- **Centrally cleared markets**



- **Bilateral markets**



Initial Margin is a Dynamic Quantity

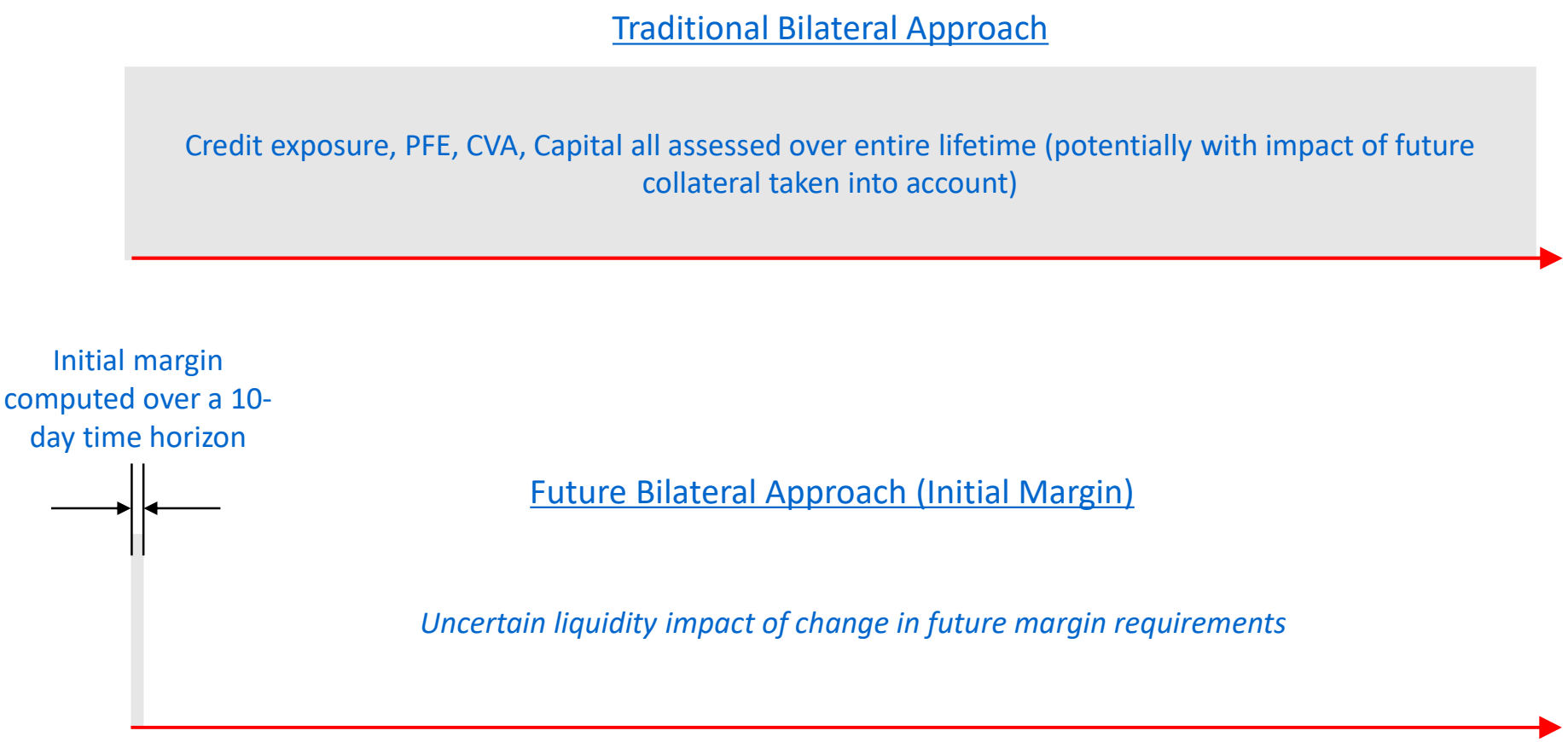
- **Historically initial margin (independent amount) has been rare and when used is often not segregated and often based on very simple metrics (e.g. percentage of notional)**
  - This makes calculation straightforward but it is not very risk sensitive (i.e. does not properly recognise portfolio diversification)
- **In the future, initial margin will be more risk sensitive and dynamic**
  - CCPs use value-at-risk (VAR) type methodologies for OTC derivatives
  - Bilateral markets will use SIMM (standardised initial margin model) which represents a simpler VAR approach based on sensitivities
  - Initial margin amounts will therefore change frequently even in the absence of trading activity (Brexit caused significant increases for GBP interest rate swaps)

Challenges of Initial Margin

- **Cost**
  - Working out the cost of future initial margin posting – margin value adjustment (MVA)
  - This is complicated massively by the fact that initial margin is dynamic and the result of a quite complicated calculation which is near impossible (and computationally difficult) to predict in the future
- **Risk mitigation benefit**
  - Working out to what extent initial margin reduces credit risk in the form of CVA (credit value adjustment) and KVA (capital value adjustment)
  - Same problems as above
- **Liquidity impact**
  - Not only the outright cost but also the liquidity impact when future initial margin requirements change
- **Unintended consequences?**

Traditional and Future Bilateral Clearing Compared

- **Take an example of a 5-year transaction**



Confidence in Initial Margin

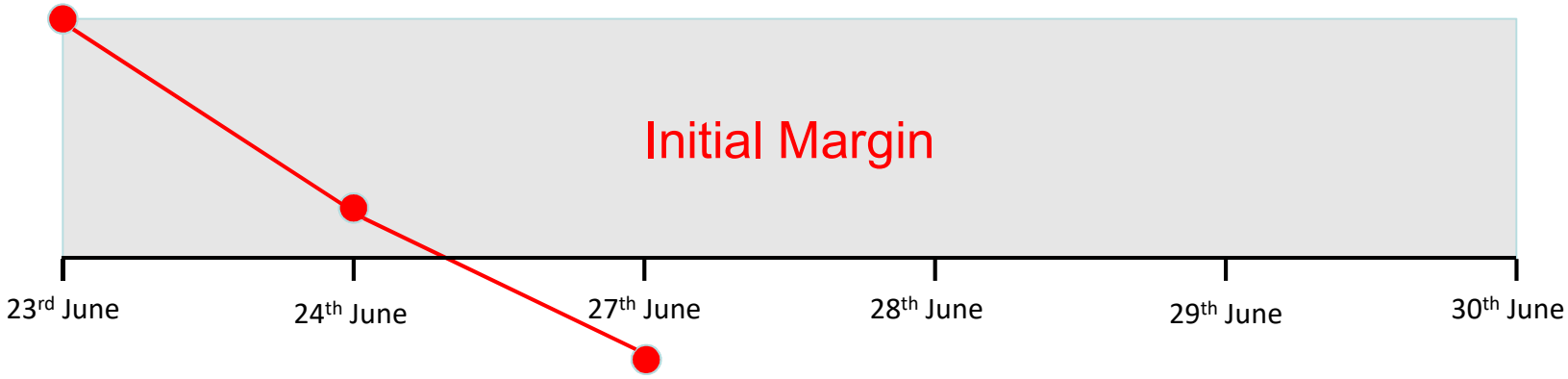
"the Risk Management Department is expected to ensure that initial margin is sufficient to cover 99.7 percent of observed profits and losses over the assumed holding period of the contract(s)"

"incorporates at least 1,260 days (5 years) of 5-day log returns and uses a 99.7% confidence level including extreme historical stress markets beyond the 5-year window (i.e. Lehman default)

"Achieves a 99% 5-day coverage standard minimum"

Where Can It All Go Wrong? – Clue from Brexit

- **Initial margin is taken by CCPs to cover at least a 99% worst case scenario over a 5-day period**
  - What happened to a GBP swap after Brexit?



  - It didn't even seem as if there was enough initial margin to cover a 2-day move
  - This does not consider the possible costs of closing out this position (luckily no-one defaulted)
  - Initial margin requirements then quickly increased by around 25% (within a week) as a result of the Brexit event

The Impact of Initial Margin

- **An obvious question is therefore:**

- **What will be the impact of initial margin posting?**
  - Cost
  - Liquidity effects
  - Risk reducing benefit
  - Impact on the balance sheet of a bank
  - Impact on bank creditors?

- **We take a first step to answering some of these questions**

Introduction

Initial Margin Requirements

Structural Model Approach

Conclusion

Simple Example

- **Suppose total claims of creditors are 60 and total assets are 30**
  - We therefore expect a 50% recovery overall
  - But what is the impact of initial margin posting?

	Claim	Initial margin	Residual claim	Recovery	Effective recovery rate
Derivatives	15	10	5	2	80%
Unsecured creditors	45	-	45	18	40%
Total	60	10	50	20	50%

- **Initial margin improves the claims of derivatives creditors at the expense of other creditors (e.g. bondholders) – Pirrong (2013)**

Merton Representation

- **Initial margin**

$$dM_t = rM_t dt$$

- **Firm value:**

$$V_t = \tilde{V}_t + M_t$$

$$d\tilde{V}_t = \mu\tilde{V}_t + \sigma dW_t$$

- **Percentage claim of derivatives creditors and other unsecured creditors ("bondholders")**

$$\alpha^D = \frac{(F^D - M_T)_+}{F^D + F^B - M_T} = 1 - \alpha^B$$

Payoffs

Default | No default

	$\tilde{V}_T + M_T < F^D + F^B$		$\tilde{V}_T + M_T \leq F^D + F^B$
	$M_T < F^D$	$M_T \geq F^D$	
Derivatives	$M_T + \alpha^D \tilde{V}_T$	F^D	F^D
Other creditors	$\alpha^B \tilde{V}_T$	$\tilde{V}_T + M_T - F^D$	F^B
Shareholders	0		$\tilde{V}_T + M_T - F^D - F^B$
Total	$\tilde{V}_T + M_T$		

Initial margin is sufficient to meet derivatives liabilities

- **Note:**
  - Derivative creditors can receive 100% recovery in default (second column)

Valuation – Derivative Creditors

- **Payoff involves short put option due to the possibility that the initial margin is not sufficient**

$$D_T = \min\left(F^D, M_T + \alpha^D \tilde{V}_T\right) = F^D - [F^D - M_T - \alpha^D \tilde{V}_T]_+$$

- **Value is therefore**

$$D_t = F^D e^{-r(T-t)} - \left[(F^D - M_T)_+ e^{-r(T-t)} \Phi(-d_2) - \alpha^D \tilde{V}_0 \Phi(-d_1)\right]$$

- **In the case $F^D \geq M_T$ then we return to the classic case where the derivative creditors are short a put option on a (smaller) loss fraction of α^D**

Valuation – Bondholders

- **Payoff involves both a short put option as expected and also a long put option where the derivative creditors are paid in full and initial margin passes to the bondholders**

$$B_T = \tilde{V}_T + M_T - [V_T + M_T - F^D - F^B]_+ - F^D + [F^D - M_T - \alpha^D \tilde{V}_T]_+$$
$$= F^B - \max(F^D + F^B - \tilde{V}_T - M_T, 0) + \max(F_D - M_T - \alpha^D \tilde{V}_T, 0)$$

- **Value is therefore**

$$B_t = F^B e^{-r(T-t)} - [(F^B + F^D - M_T) - (F^D - M_T)_+] e^{-r(T-t)} \Phi(-d_2) + \alpha^B \tilde{V}_0 \Phi(-d_1)$$

- **In the case $F^D \geq M_T$ then we return to the classic case where the derivative creditors are short a put option on a (larger) loss fraction of α^B**

Loss Given Default

- **Default probability**

$$Q_T = \Pr\left(\tilde{V}_T + M_T < F^B + F^C\right) = \Phi(-d_2)$$

- **Expected loss given default (LGD) of derivative creditors can be shown to be:**

$$LGD_t^D = \frac{1}{F^D}\left[(F^D - M_T)_+ - \frac{\alpha^D \tilde{V}_T \Phi(-d_1)}{e^{-r(T-t)}\Phi(-d_2)}\right]$$

- **Expected LGD of bondholders:**

$$LGD_t^B = \frac{1}{F^B}\left[(F^B + F^D - M_T) - (F^D - M_T)_+ - \frac{\alpha^B \tilde{V}_0 \Phi(-d_1)}{e^{-r(T-t)}\Phi(-d_2)}\right]$$

Credit Spreads

- **Implied credit spreads can be found via solving:**

$$X_t = F^X \exp\left[-\left(r + s_{t,T}\right)(T-t)\right]$$

- **Derivatives creditors:**

$$s^D_{t,T} = -\frac{1}{T-t} ln\left[1 - \frac{(F^D - M_T)_+}{F^D}\Phi(-d_2) + \frac{\alpha^D \tilde{V}_0 \Phi(-d_1)}{F^D e^{-r(T-t)}}\right]$$

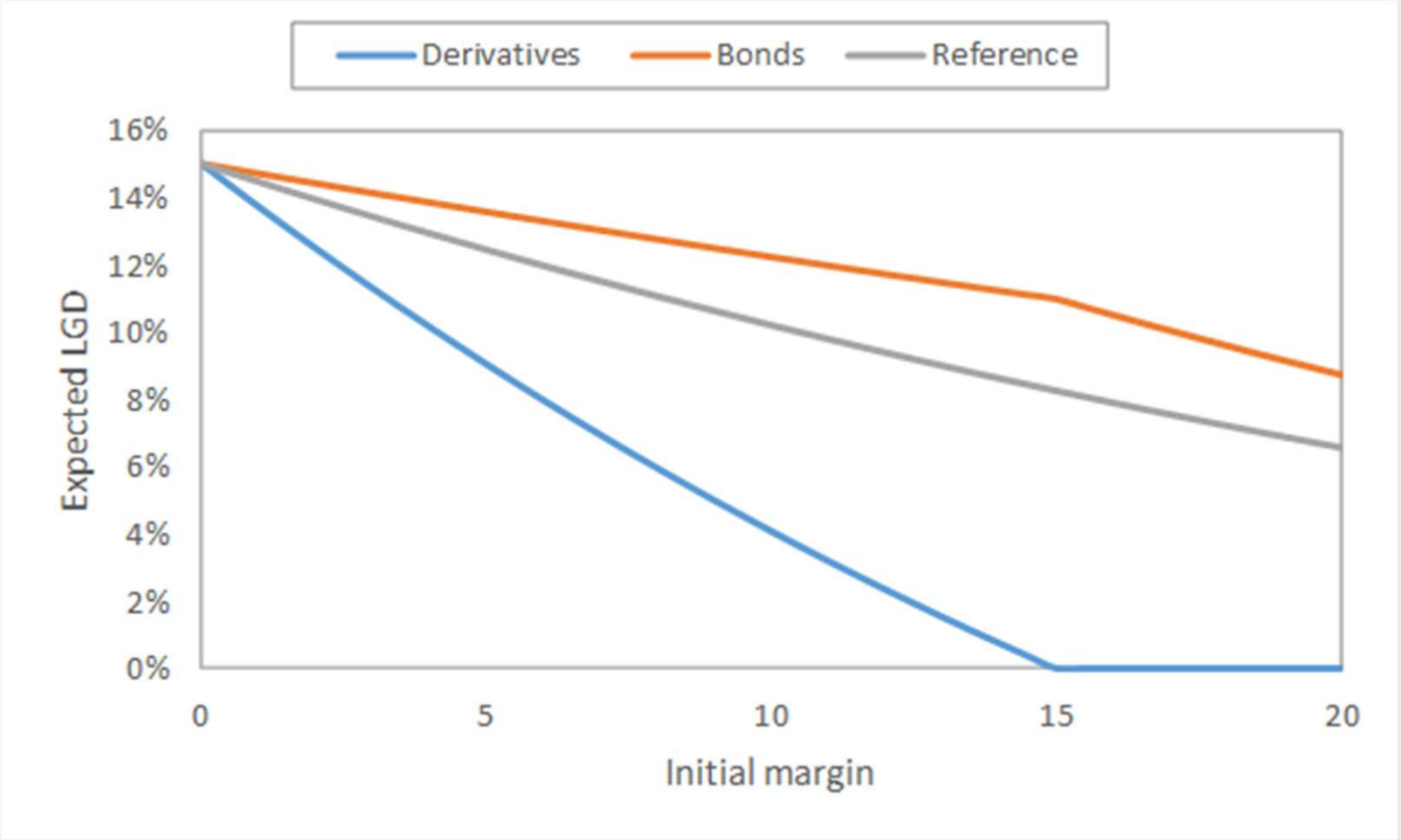
- **Bondholders:**

$$s^B_{t,T} = -\frac{1}{T-t} ln\left[1 - \frac{[(F^B + F^D - M_T) - (F^D - M_T)_+]}{F^B}\Phi(-d_2) + \frac{\alpha^B \tilde{V}_0 \Phi(-d_1)}{F^B e^{-r(T-t)}}\right]$$

Reference Case

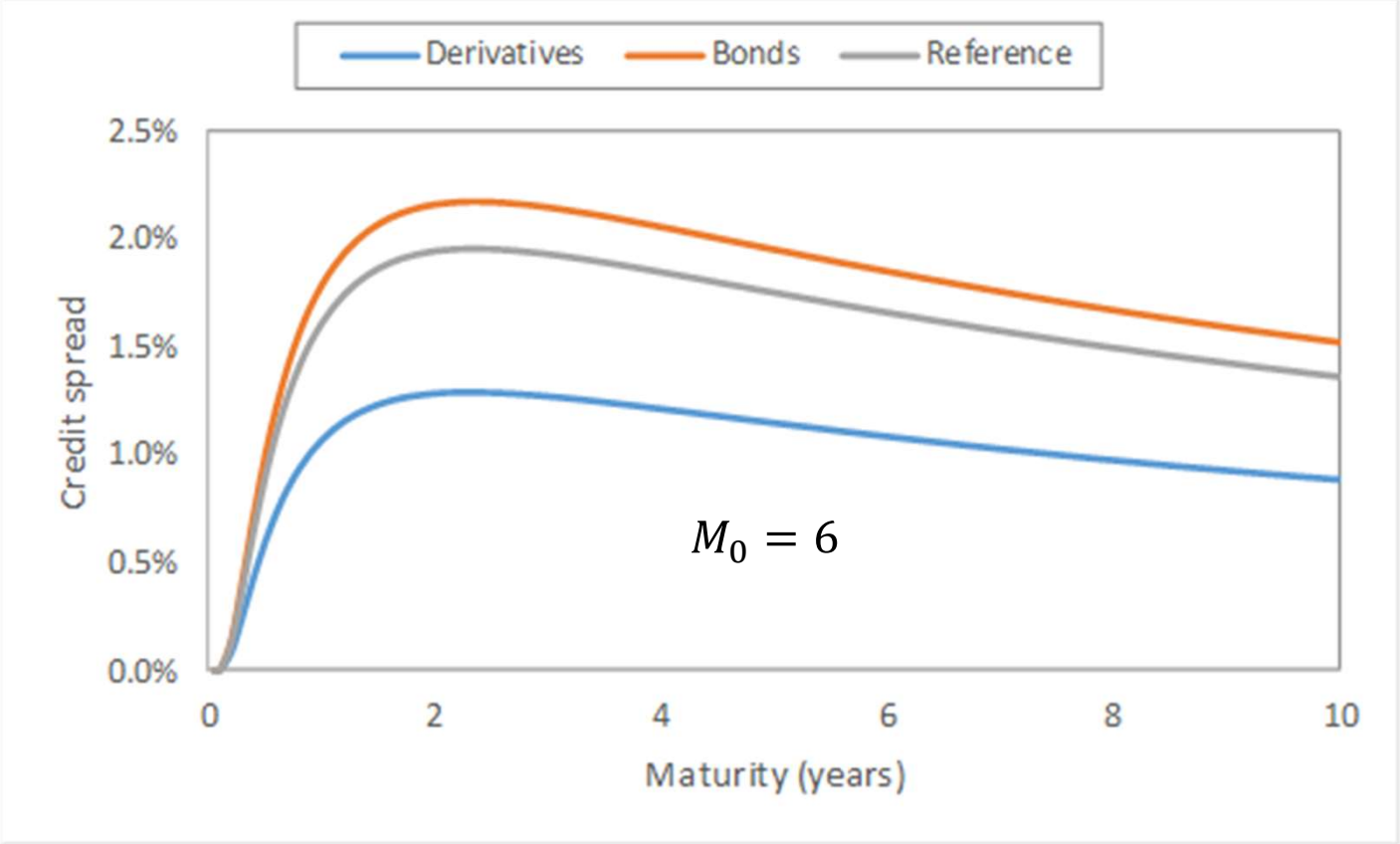
- **We also use as a reference a case where the derivatives creditors and bondholders have the same seniority via having a pro-rata share of the initial margin (this does not occur in reality unless of course the bondholders challenge payments in the event of bankruptcy – some precedent for this in the case of SPVs)**

Examples (I)



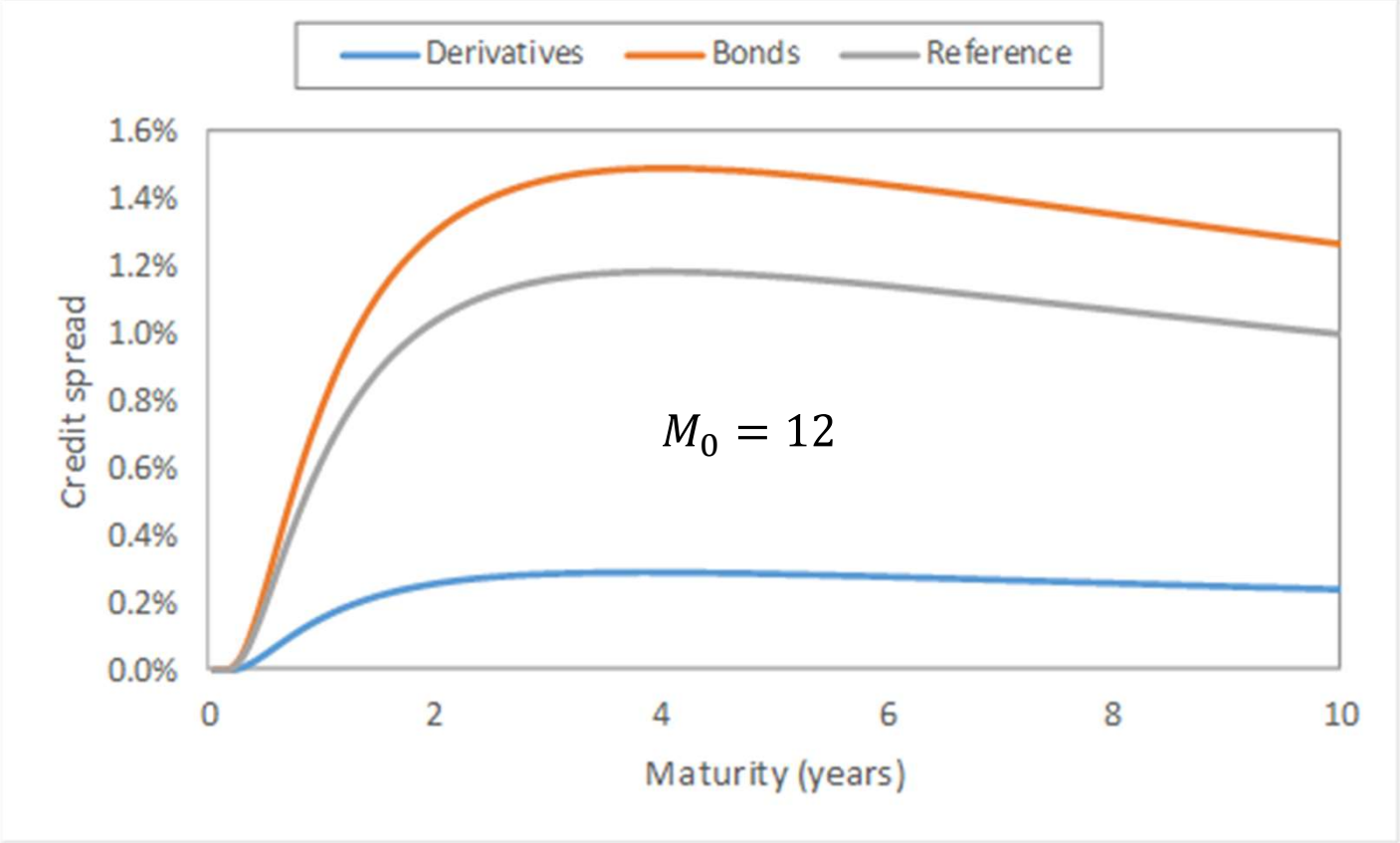
$$\tilde{V}_0 = 75,\ F^D = 15,\ F^B = 45,\ \sigma = 30\%,\ (T-t) = 1,\ r = 5\%$$

Examples (II)



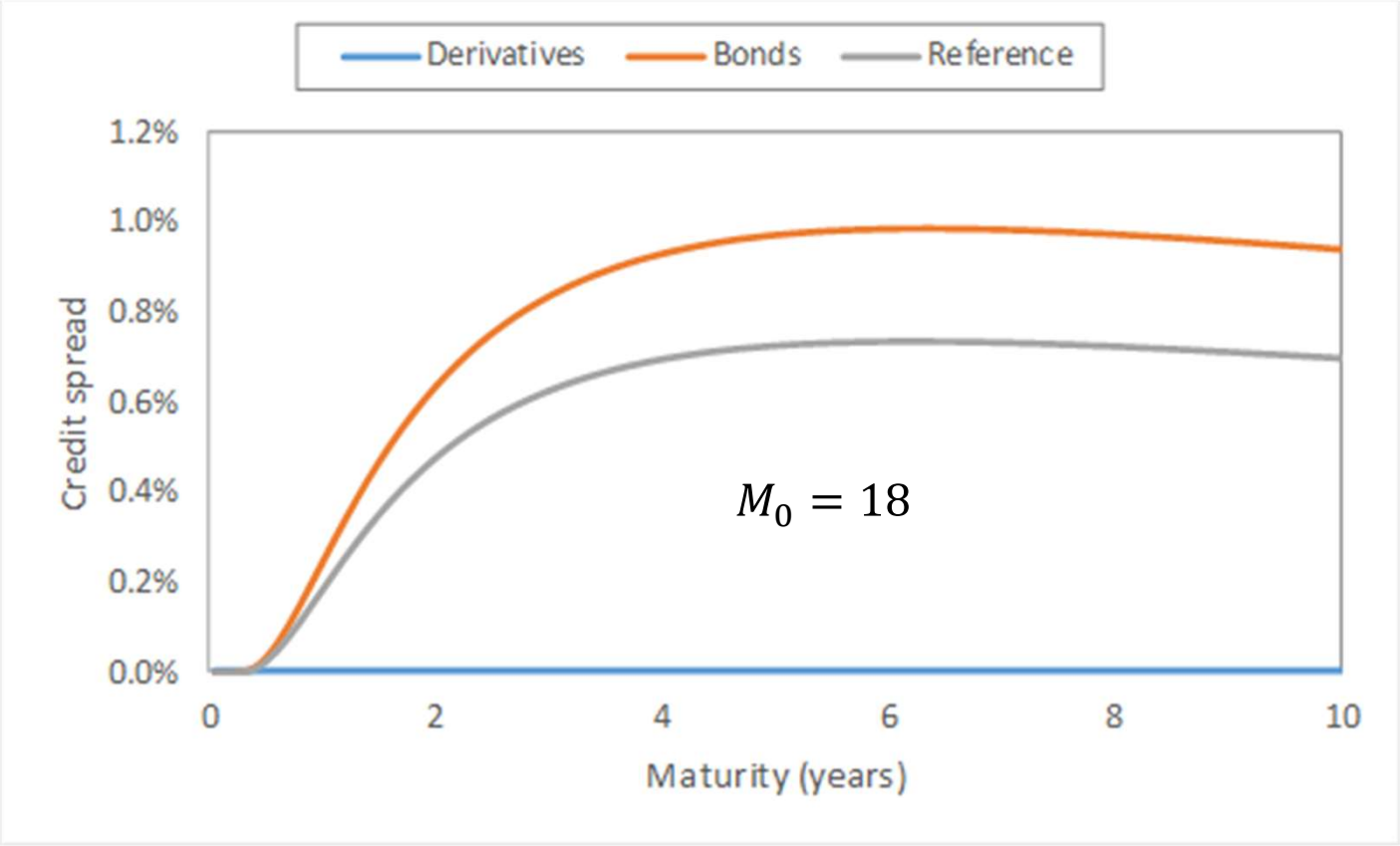
$$\tilde{V}_0 = 75, F^D = 15, F^B = 45, \sigma = 30\%, (T-t) = 1, r = 5\%$$

Examples (III)



$$\tilde{V}_0 = 75, F^D = 15, F^B = 45, \sigma = 30\%, (T-t) = 1, r = 5\%$$

Examples (IV)



$$\tilde{V}_0 = 75, F^D = 15, F^B = 45, \sigma = 30\%, (T-t) = 1, r = 5\%$$

Introduction

Initial Margin Requirements

Structural Model Approach

Conclusion

Conclusions

- **Does initial margin reduce systemic risk?**
- **Posting initial margin creates a wealth transfer from derivative creditors to other creditors**
  - Bondholders therefore experience higher LGDs and credit spreads as initial margin increases
- **Implications**
  - If there is a systemic risk reduction then it is only in the derivatives market and systemic risk might increase in other markets
  - Bondholders should require higher returns for lending banks money due to initial margin posting to derivative counterparties
  - This in turn may lead to some bespoke funding arrangements and increased collateral transformation
  - Will such mechanisms just break-down in a crisis?