Compressing over-the-counter markets

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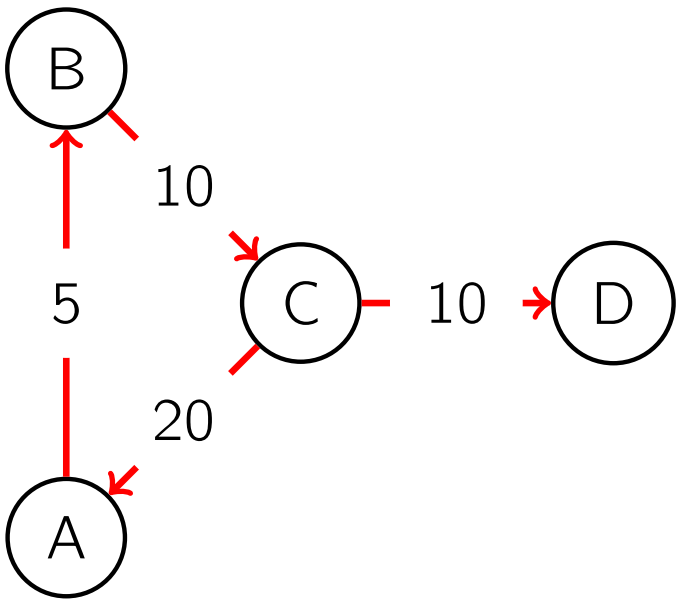
Outline

1. What is compression? The main intuition
2. Historical background
3. Theory:
   - Key concepts: excess, conservative vs non-conservative compression, tolerances
   - Mechanics: conditions, efficiency, characterisation of network structure
4. Empirics:
   - Impact of a EU-wide adoption of compression (via EMIR data, CDS)
   - How much notional can be eliminated?

What is compression?

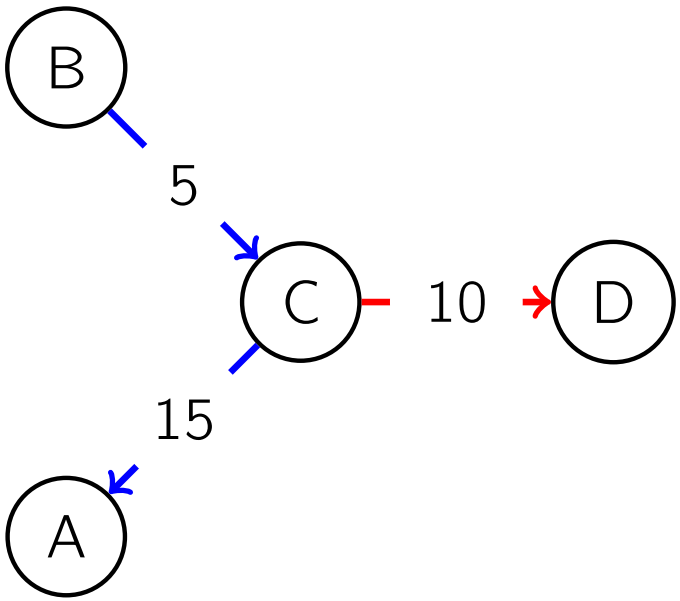
- **OTC derivatives markets**: complex, opaque, large notional amounts
- **Compression in a nutshell**: *post-trade* operation that reduces gross positions while preserving net positions



Gross	*Net*
$v_A^g = 25$	$v_A^n = -15$
$v_B^g = 15$	$v_B^n = +5$
$v_C^g = 40$	$v_C^n = +20$
$v_D^g = 10$	$v_D^n = -10$
$V^g = 45$	$V^n = 0$

What is compression?

Compression in a nutshell: *post-trade* operation that reduces gross positions while preserving net positions



	Gross	*Net*
A	$v_A^g = 15$	$v_A^n = -15$
B	$v_B^g = 5$	$v_B^n = +5$
C	$v_C^g = 30$	$v_C^n = +20$
D	$v_D^g = 10$	$v_D^n = -10$
	$V^g = 30$	$V^n = 0$

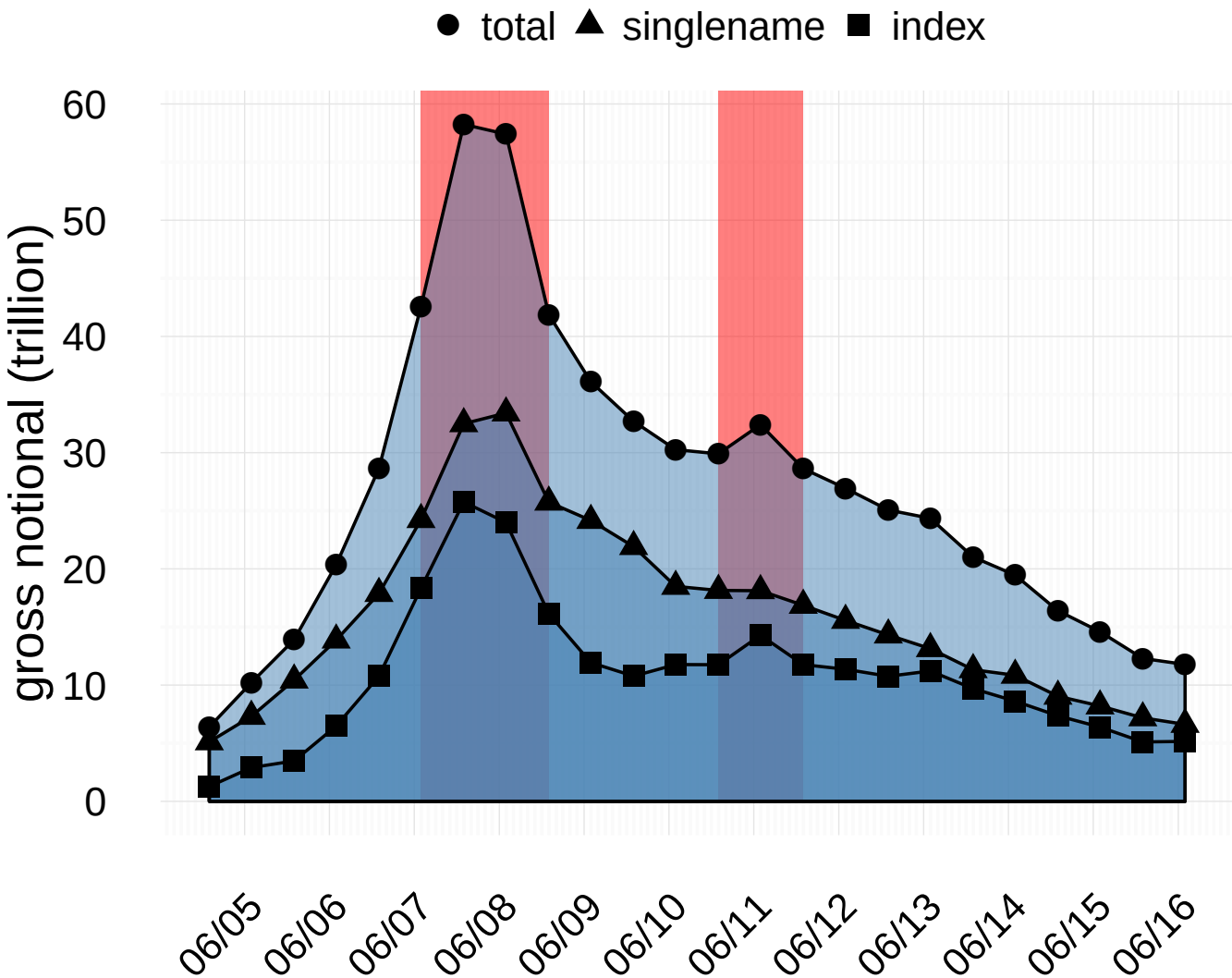
Gross notional reduction: 15

System-wide deleveraging
which does not entail asset sales or additional capital

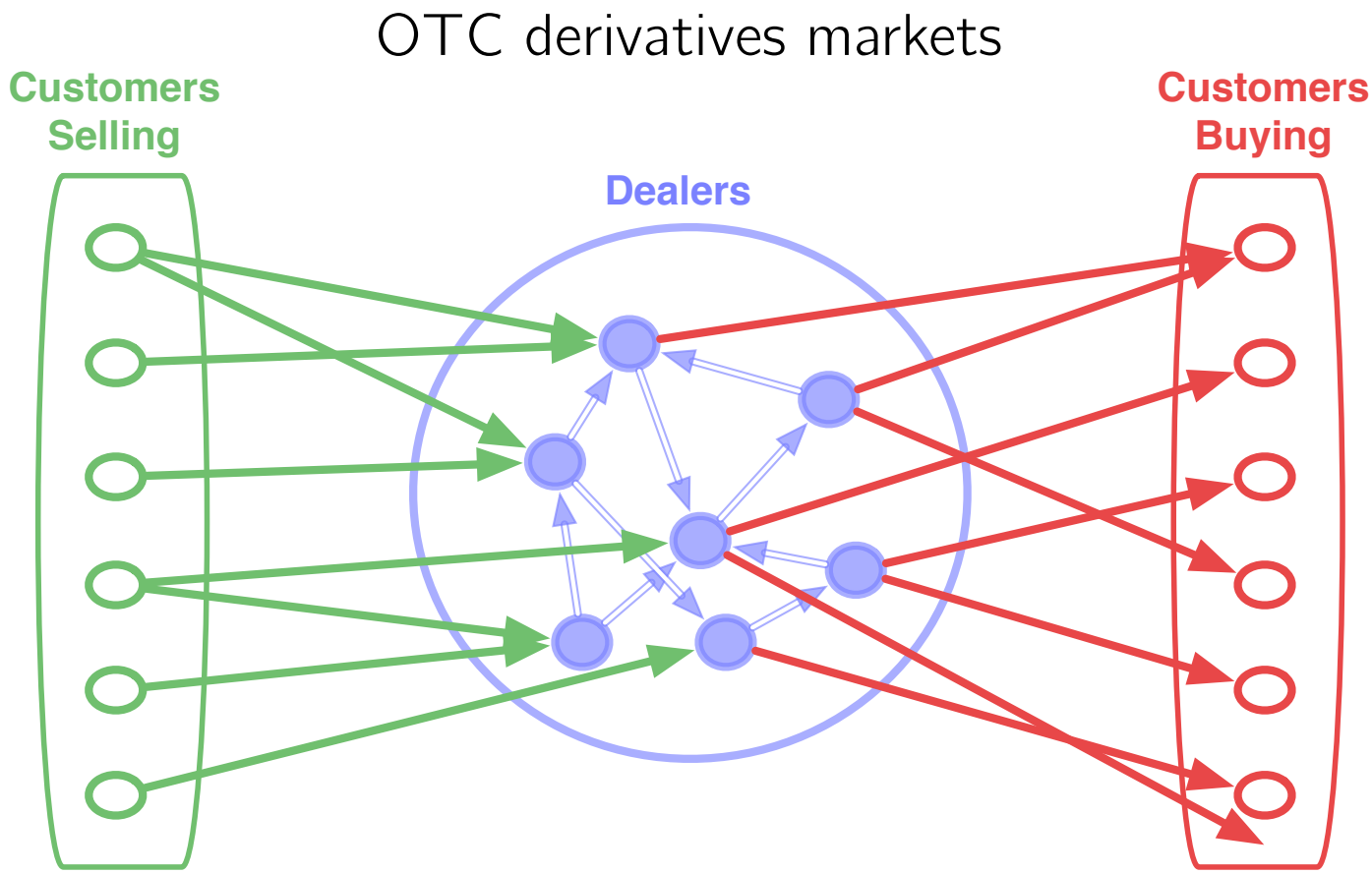
“Size” of OTC derivatives markets

Credit Default Swaps (source: BIS OTC derivatives statistics)

“significant decline” due to compression (BIS QR) - 85 T eliminated through 2012 (ISDA)



How did we get there? Part 1



Complex **Opaque** **Large**

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Global Reform of Financial Markets
(G-20 Post-Crisis Summit, 2009)

How did we get there? Part 2

Compression introduced in early 2000s

- Good housekeeping
  - Counterparty risk ↓
  - Operational management ↓

2008 GFC aftermath (1)

"Only now is the industry discovering the **joys of compression***"*
The Economist, November 2008

How did we get there? Part 2

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- Good housekeeping
  - Counterparty risk ↓
  - Operational management ↓

Crisis aftermath (2)

New regulatory constraints

↙ ↓ ↘

Capital requirements | Leverage ratio | Margins / collateral

How did we get there? Part 2

Compression introduced in early 2000s

- Good housekeeping
  - Counterparty risk ↓
  - Operational management ↓

Crisis aftermath (3)

Regulatory assessment

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Compression is

"greatest source of improvement in OTC derivatives exposure"

(Duffie, 2017)

Compression today

How?

- Bilateral level → Mutual agreement
- Multilateral level → External service provider

(TriOptima, LCH SwapClear, LMRKTS, Catalyst, Markit)

What?

- IRS (cleared and non-cleared), CDS (single-name and index)
- More recently: FX, Commodity, Inflation, Currency, etc.

Numbers

- TriOptima: $1000 trillion eliminated (cumulative, 2003-2017)
- LCH SwapClear: $380 billions eliminated in 2016
- ISDA: 67% reduction of IRD markets (2010-2016)

Regulations

- Defined in MiFIR
- EMIR art. 14 requires "valid explanation" for not compressing

Why care?

Global Regulatory Support
MiFIR, EMIR, Dodd-Frank

- Reduction of Systemic Risk + Increase of Transparency

However...

Systemic Risk
(partial) reconfiguration

- Local vs. global
- Risk concentration
- Legal framework

Monitoring/Regulation
lack of tractability

- Opaque methods
- Limitations in current reporting framework
- Aggregate measurements may be distorted

... and

Limited literature and analytical research on the topic

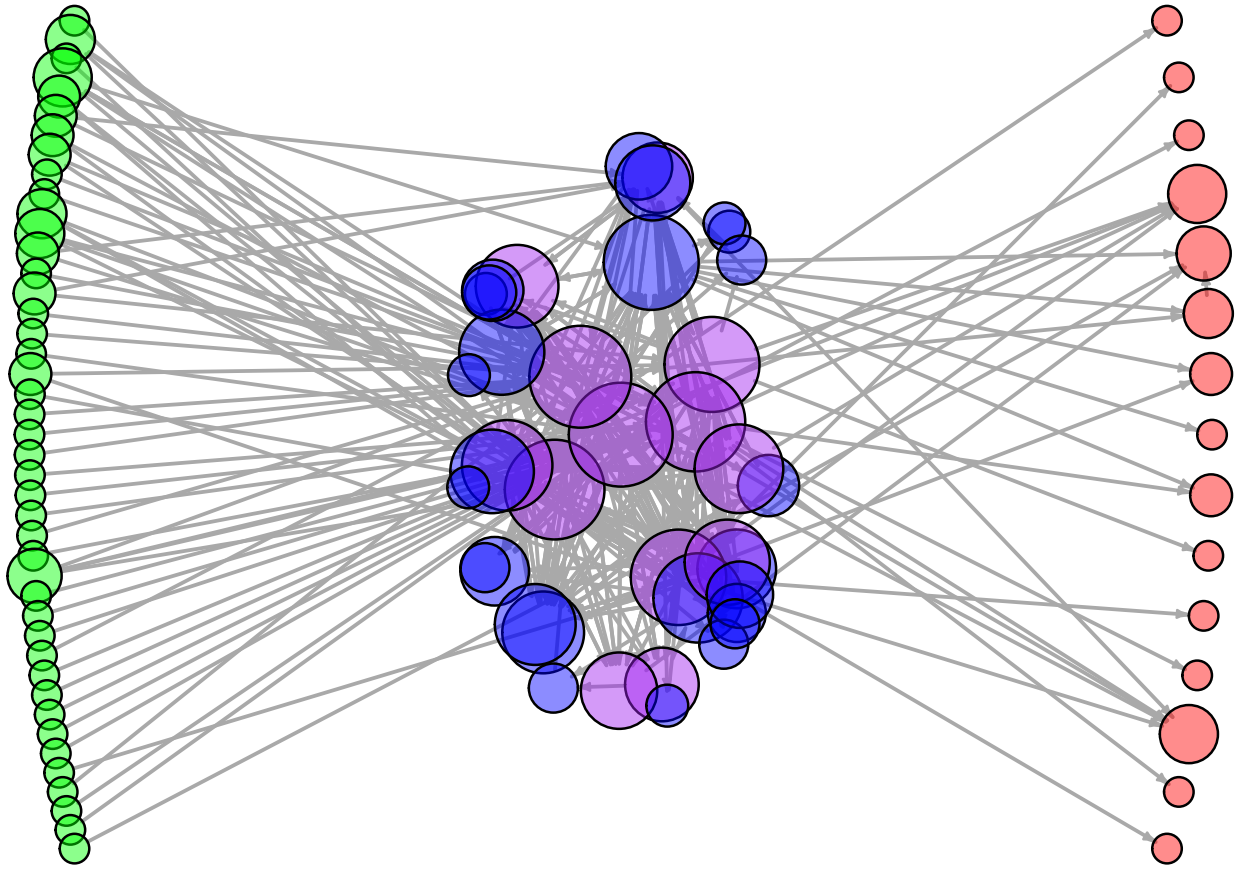
(O'Kane, 2014 WP), (Benos et al., 2013, BoE WP), (Schrimpf, 2015 BIS QR), (Duffie 2017, MS)

Mapping OTC Markets

Dealers and Customers

EMIR CDS on large sovereign (April 2016)

Total gross notional: 15.95*Bn* euros



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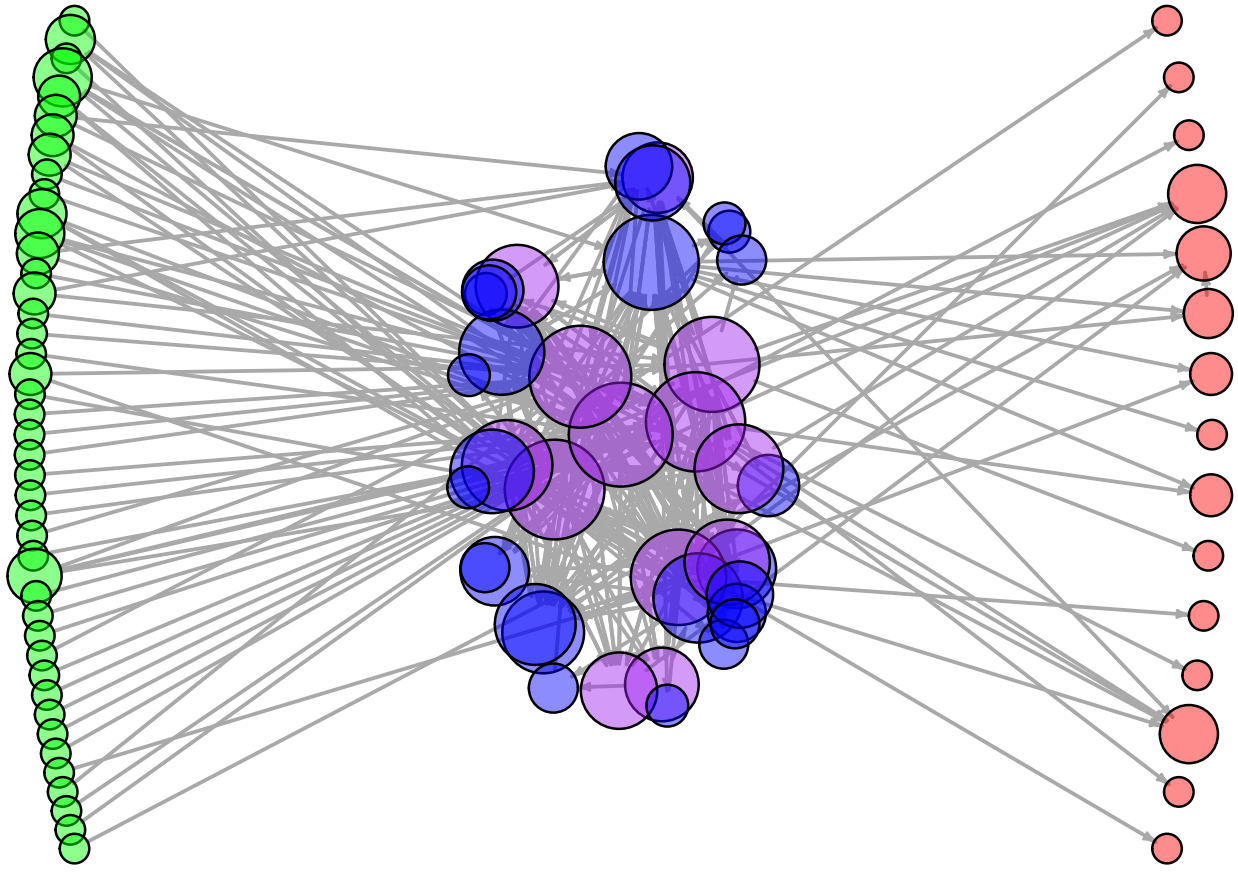
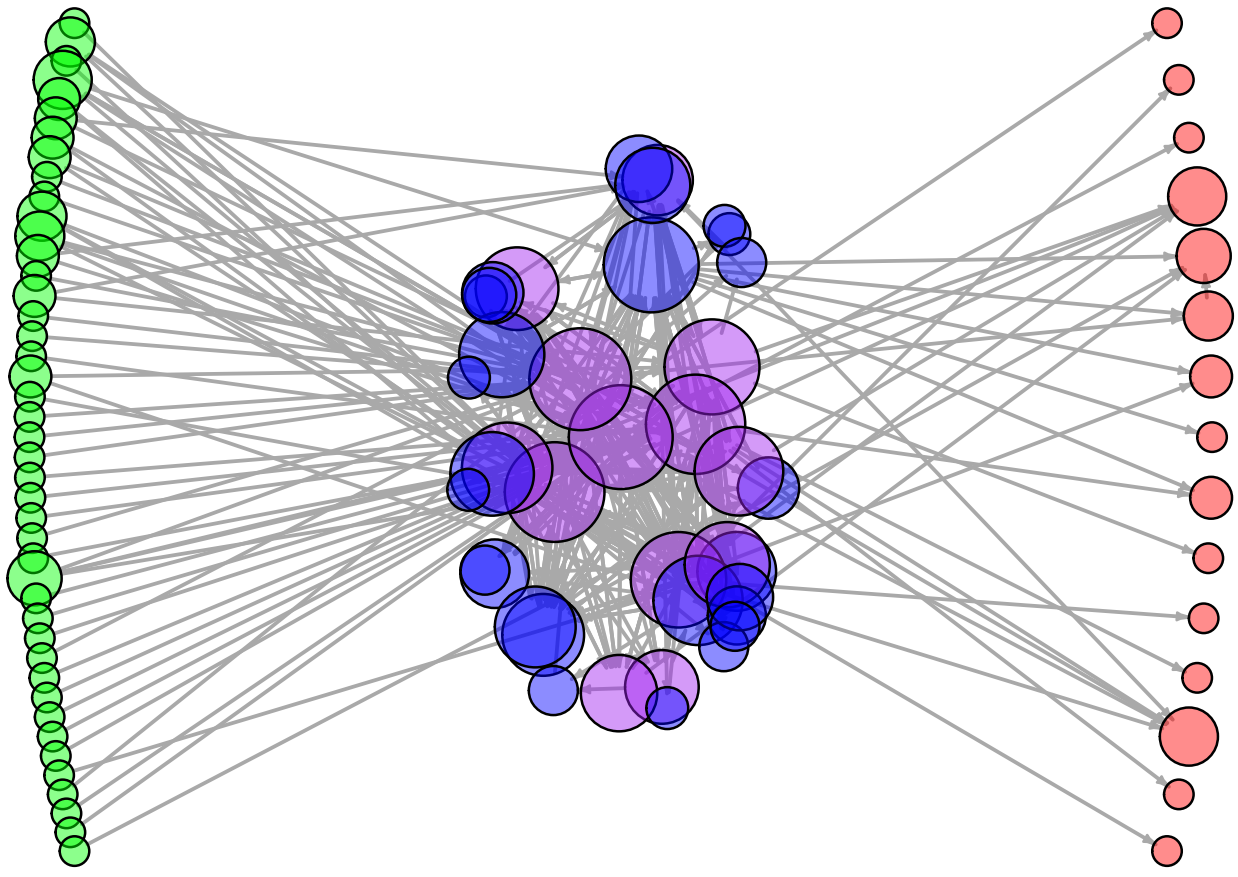
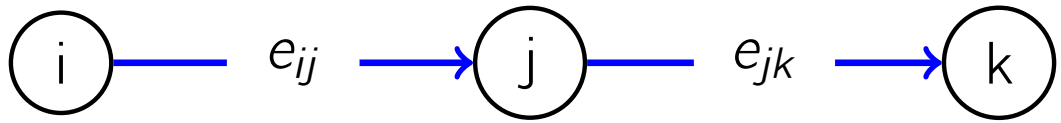


1.6 % **96.6 %** **1.9 %**

Mapping OTC Markets



Excess

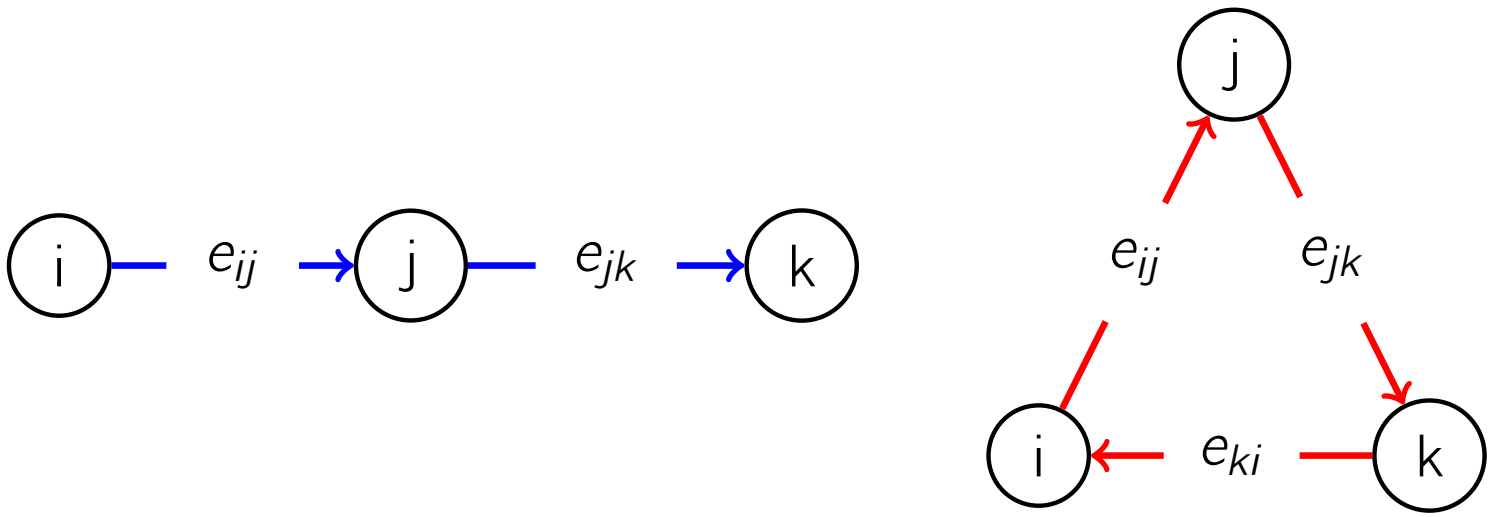


$$\text{excess notional} = \underbrace{\sum_{i,j} e_{ij}}_{gross\ \ notional} \quad \underbrace{- \frac{\left(\sum_i \left| \sum_j e_{ij} - \sum_j e_{ji} \right|\right)}{2}}_{minimum\ \ notional}$$

Excess

$$\text{excess notional} = \underbrace{\sum_{i,j} e_{ij}}_{\textit{gross notional}} \underbrace{- \frac{\left(\sum_i \left|\sum_j e_{ij} - \sum_j e_{ji}\right|\right)}{2}}_{\textit{minimum notional}}$$

- In a market (trades are fungible and outstanding), there is excess if and only if there is intermediation



Compression

Definition: operation over the market that **reconfigures** the web of outstanding trades s.t. the resulting market:

- Preserves net positions → **unchanged market risk**
- Reduces excess → **reduction of counterparty risk**
- Satisfies pre-determined tolerance levels (bilateral counterparty constraints set by participants)

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Efficiency criteria

Excess Reduction

Classification

Two benchmark classes of compression based on tolerances

Conservative
With counterparty relationship constraints

Non-conservative
No counterparty relationship constraints

Necessary and sufficient condition (Feasibility)

Efficiency

Results: trade-off in netting efficiency

Conservation (counterparty relationships)

Conservative	**Non-conservative**
Link-constrained	No link constraints

Feasibility

Closed intermediation chains	Presence of intermediaries

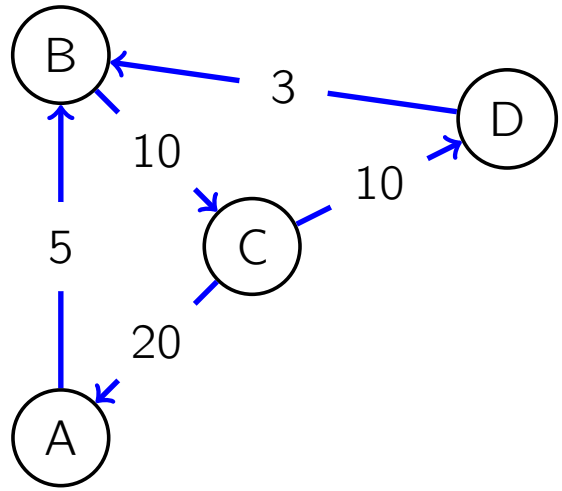
Efficiency

Never fully efficient	Fully efficient
Excess > 0	Excess $= 0$

Network structure

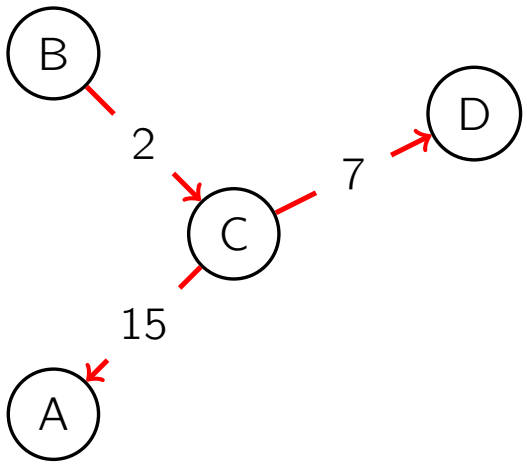
No closed intermediation chains	No more intermediation
(preserves intermediation)	(buyers matched with sellers)

Illustration: conservative vs non-conservative



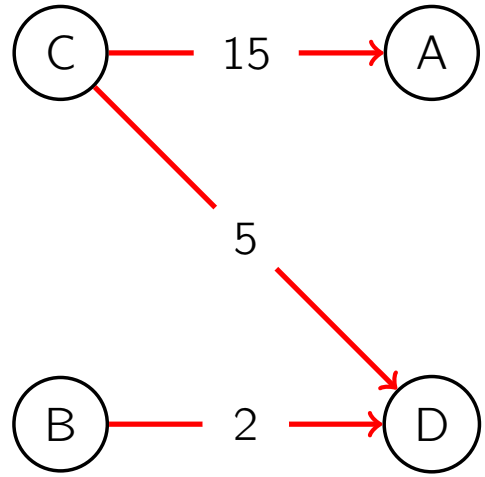
Excess = 26

Conservative



Excess = 2

Non-conservative



Excess = 0

A third approach: hybrid compression

Hybrid Compression

Assumptions

1. Dealers want to keep their intermediation role with customers
2. Intra-dealer trades can be switched at negligible cost

Implementation

- E^C is the set of dealer-customer trades → **conservative**
- E^D is the set of intra-dealer trades → **non-conservative**
- $E^C + E^D = E$

Efficiency ranking

$$\text{bilateral} \leq \text{conservative} \leq \text{hybrid} \leq \text{non-conservative}$$

Application

Data

Trade state report under EMIR: EU-wide Credit Default Swaps (see ESRB OP 11)

- Oct 2014 - Apr 2016
- 100 most traded instruments (ref. entity + maturity) ≈ 70 Bn euros

Implementation

- Design benchmark solution for each approach
  - Non-conservative
  - Conservative
  - Hybrid
  - Bilateral

Analysis

- Excess
- Compression efficiency

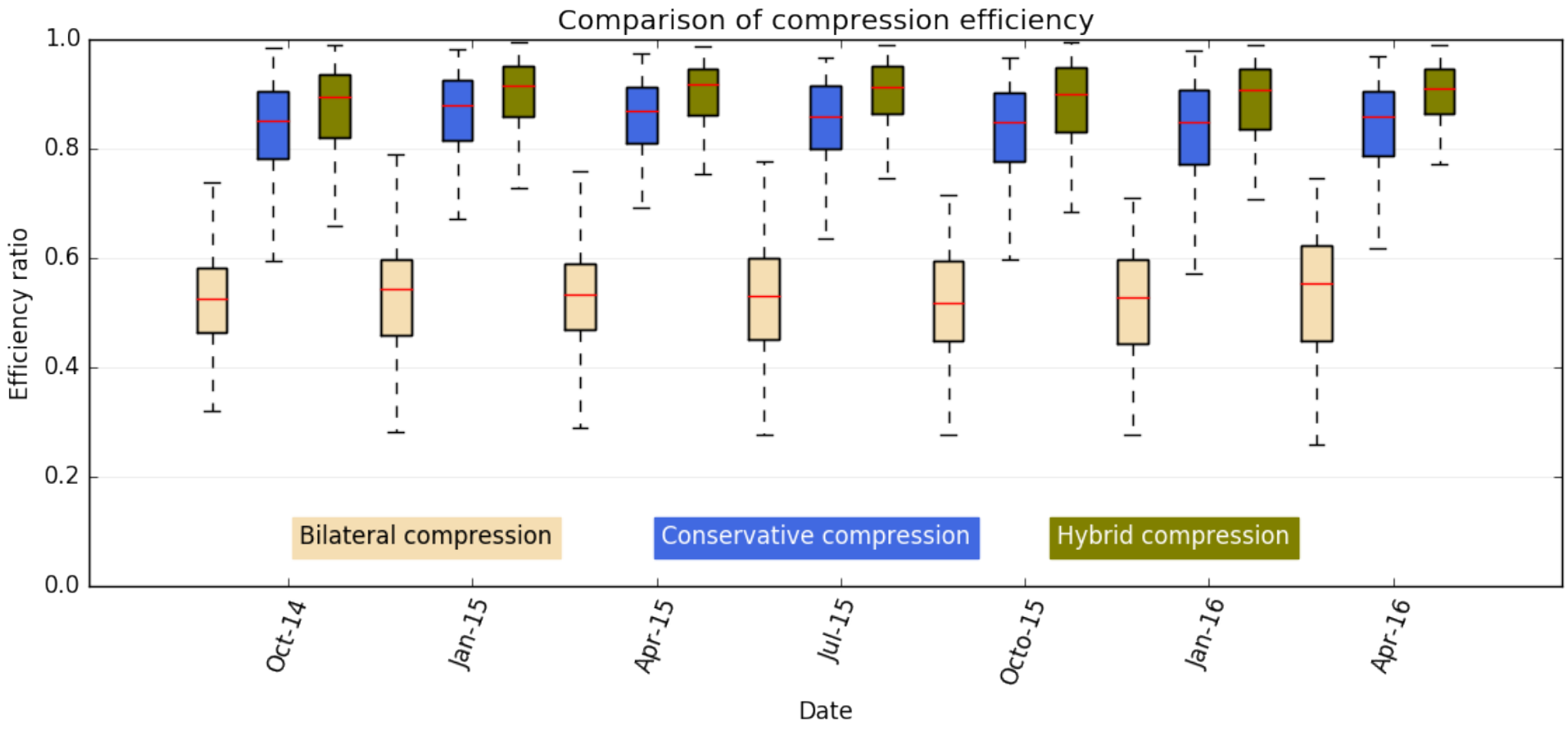
Results

Top 100 markets

Total Excess	Oct-14	Jan-15	Apr-15	Jul-15	Oct-15	Jan-16	Apr-16
min	0.529	0.513	0.475	0.420	0.533	0.403	0.532
max	0.904	0.914	0.895	0.901	0.903	0.890	0.869
mean	0.769	0.777	0.766	0.757	0.751	0.728	0.734
stdev	0.077	0.082	0.085	0.090	0.082	0.096	0.080
first quart.	0.719	0.733	0.712	0.703	0.693	0.660	0.678
median	0.781	0.791	0.783	0.769	0.758	0.741	0.749
third quart.	0.826	0.847	0.832	0.822	0.808	0.802	0.796

Results

Top 100 markets



Conclusion

- Networked markets with fungible trades generate **excess** notional obligations when there is **intermediation**
- Excess can be removed by **compression**
- Compression is widely used in OTC **derivatives** markets
- Theoretical understanding of the **mechanics**
  - Tolerances, feasibility, efficiency trade-off, design
- Empirical **application**
  - Large levels of excess, concentration in the intra-dealer segment, efficiency of multilateral approaches despite trade-off

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Towards an understanding of the systemic implications of compression

Ongoing research

1. Macro-prudential & crisis management tool
   - e.g.: “compressing” in a Lehman-type event
   - impact on margins and procyclicality
2. Epistemology of derivatives market size and impact on underlying
3. Liquidity improvement/distortion
4. CCP and netting efficiency
5. Impact on capital, collateral and prices
6. Legal framework

Thank you!

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