Compressing over-the-counter markets

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Measurement and Control of Systemic Risk

Centre de Recherches Mathématiques, Montréal

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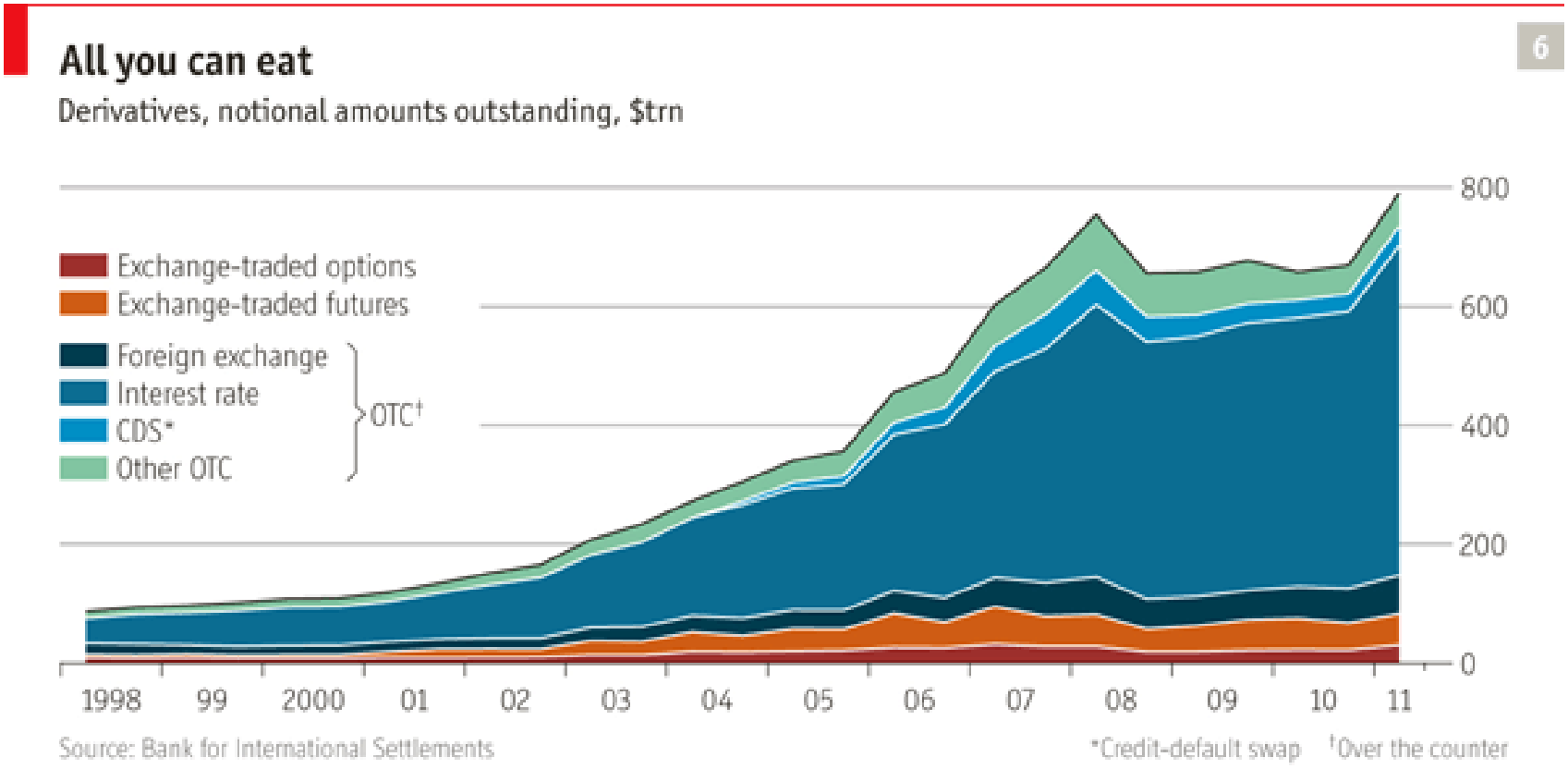
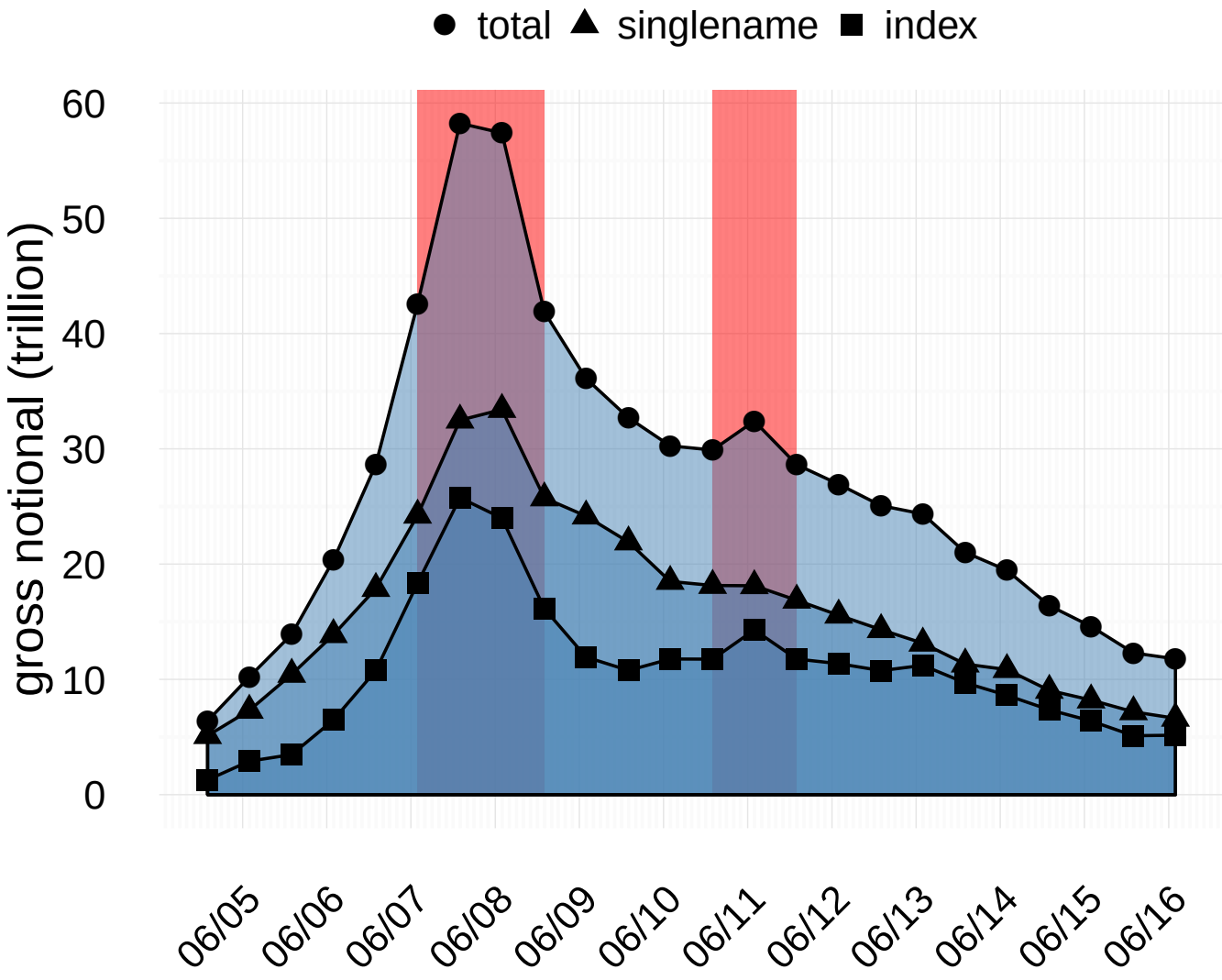
“Size” of OTC derivatives markets



The Economist, 2012

“Size” of OTC derivatives markets

Credit Default Swaps (source: BIS OTC derivatives statistics)



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In a nutshell

Post-trade Operation that reduces gross positions while satisfying net balances

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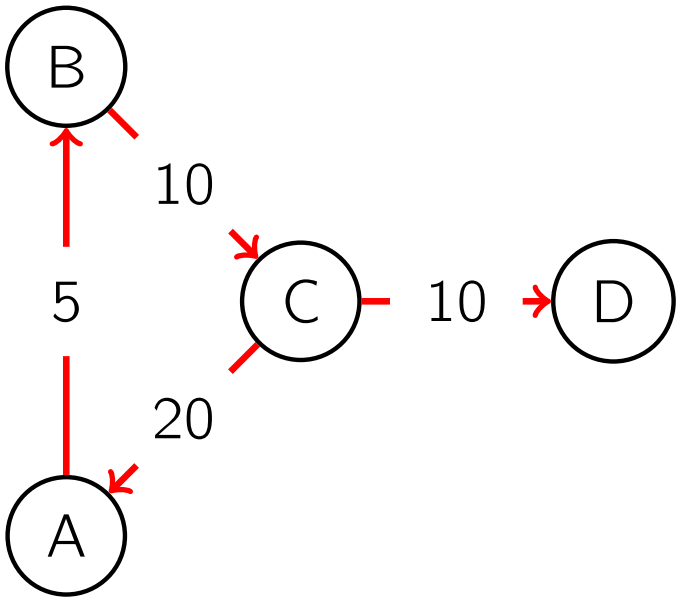

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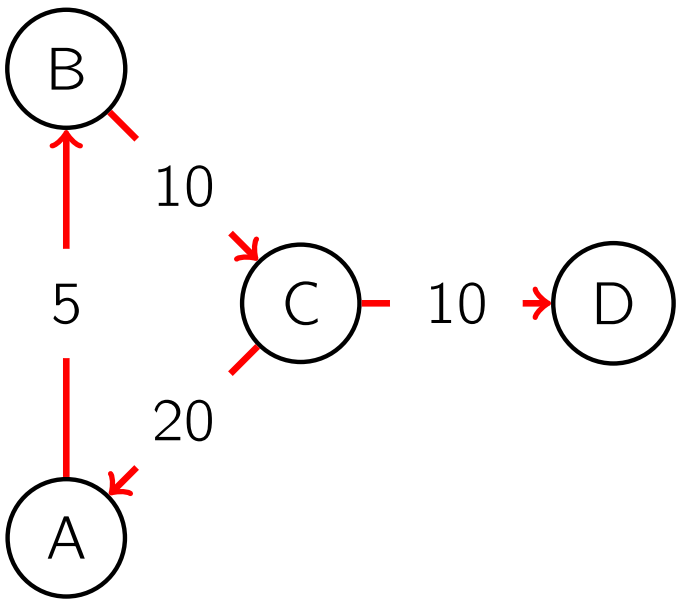

Gross	*Net*
$v_A^g = 25$	$v_A^n = -15$
$v_B^g = 15$	$v_B^n = +5$
$v_C^g = 40$	$v_C^n = +20$
$v_D^g = 10$	$v_D^n = -10$
$V^g = 45$	$V^n = 0$

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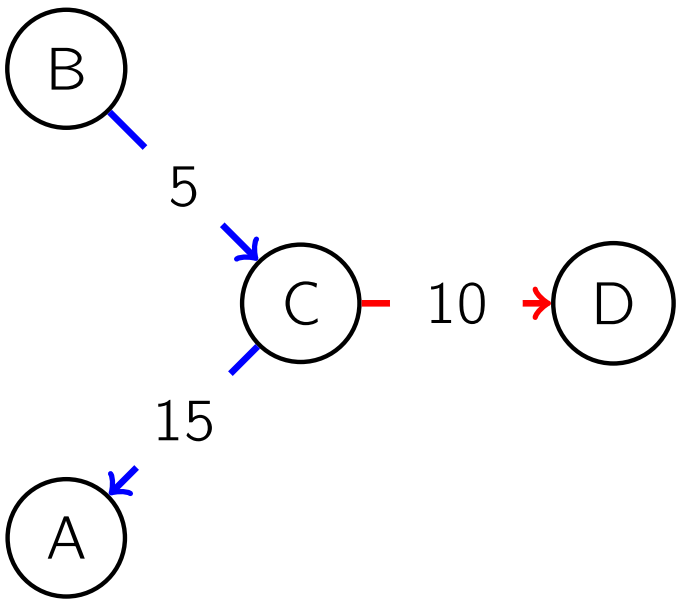

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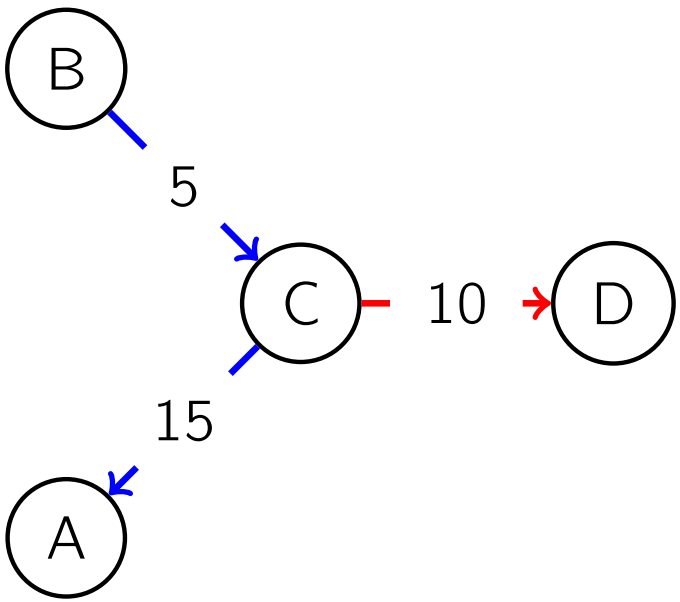

	Gross	*Net*
A	$v_A^g = 15$	$v_A^n = -15$
B	$v_B^g = 5$	$v_B^n = +5$
C	$v_C^g = 30$	$v_C^n = +20$
D	$v_D^g = 10$	$v_D^n = -10$
	$V^g = 30$	$V^n = 0$

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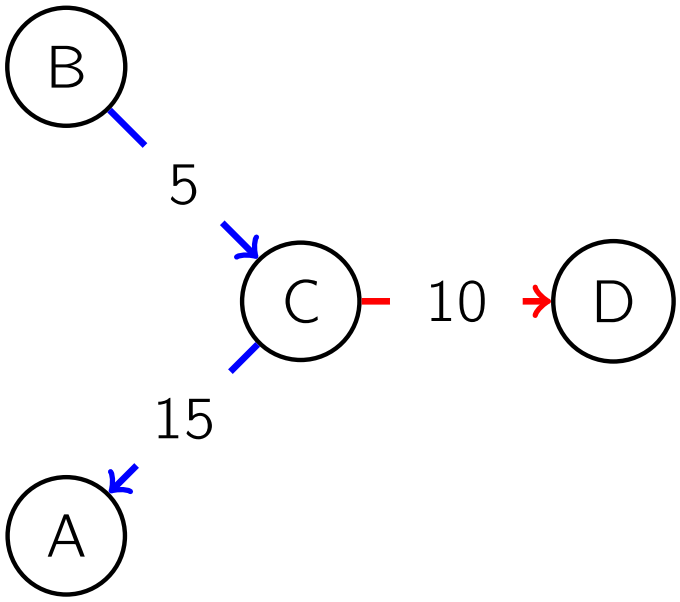
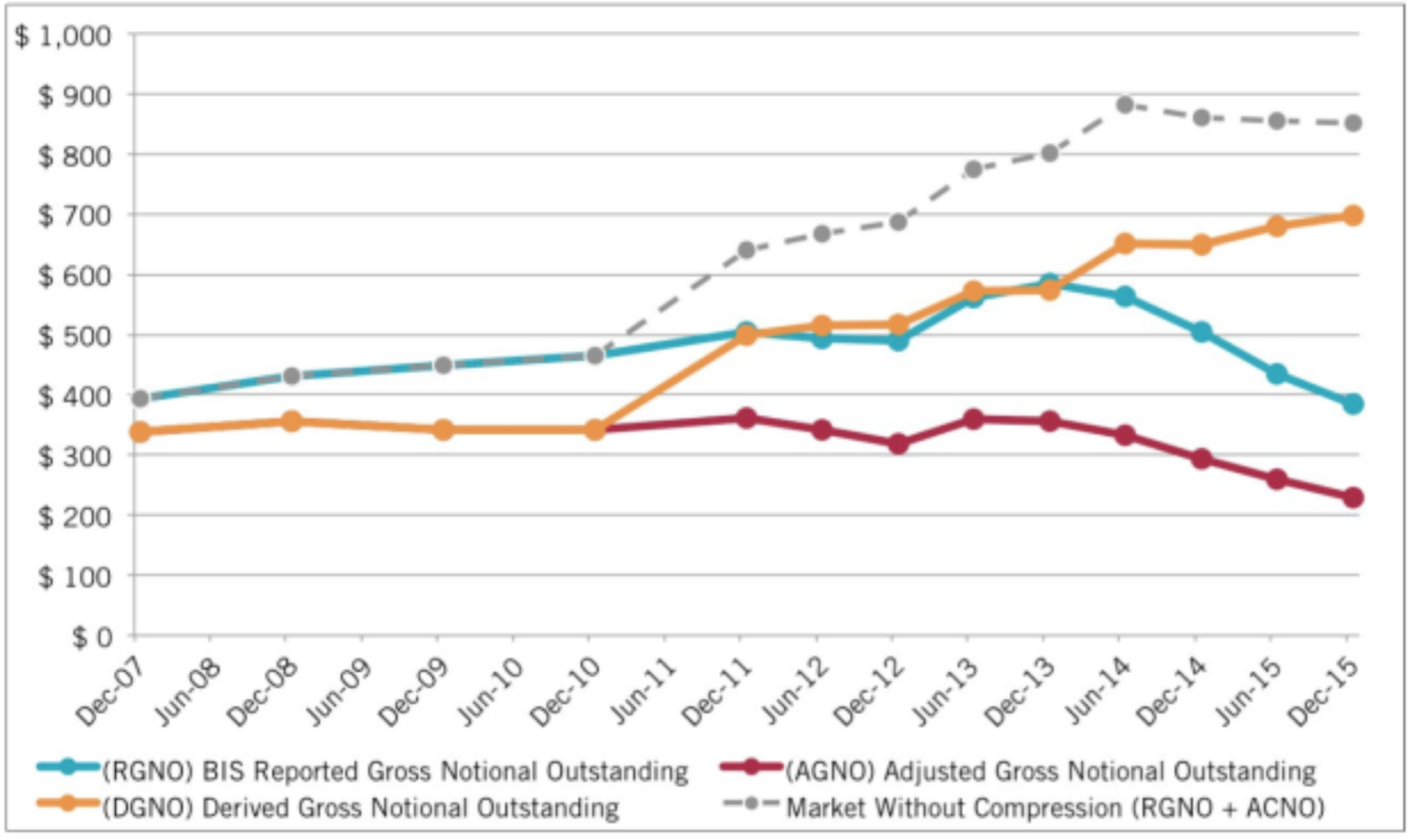


	Gross	*Net*
v_A	$v_A^g = 15$	$v_A^n = -15$
v_B	$v_B^g = 5$	$v_B^n = +5$
v_C	$v_C^g = 30$	$v_C^n = +20$
v_D	$v_D^g = 10$	$v_D^n = -10$
V	$V^g = 30$	$V^n = 0$

Reduction in aggregate gross notional: 15

"Size" of OTC derivatives markets

Interest Rates Swaps (source: ISDA Report, 2016)



Source: BIS, CME Group, JSCC, LCH.Clearnet, TriOptima

How did we get there? Rewind

Compression introduced in the middle of 2000s

- Good housekeeping
  - Counterparty risk ↓
  - Operational management burden ↓

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2008 crisis aftermath (1)

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

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New Regulatory Constraints (e.g., Basel 3)

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Capital requirements Leverage ratio Margins and collateral

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New interpretation of compression

System wide multilateral deleveraging operation which does not entail asset sales or capital injection

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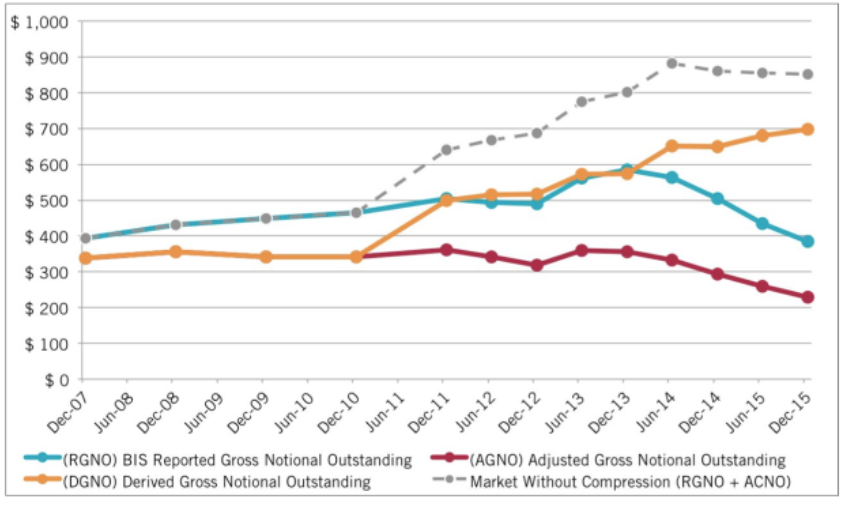

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Compression Today

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 (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

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However...

Systemic Risk
(partial) reconfiguration

- Local vs. global
- Risk concentration
- Legal framework

Monitoring
lack of tractability

- Opaque methods
- Limitations in current reporting framework
- Distortion of aggregate assessments

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... And

Limited literature and analytical research on the topic

(O'Kane, 2014 WP), (Benos et al., 2013, BoE WP)

Today

1. Formalize key concepts related to portfolio compression
   - Excess
   - Tolerance
     - Conservative vs Non-conservative
2. Identify the mechanics of compression
   - Condition
   - Efficiency
   - Topological characterisation
3. Apply the framework to CDS markets
   - How much notional is eligible for compression
   - Impact of a EU-wide adoption of compression

Mapping Financial Markets

Dealers and Customers

EMIR CDS on Government Reference (April 2016)

Total gross notional: $15.95Bn$ euros

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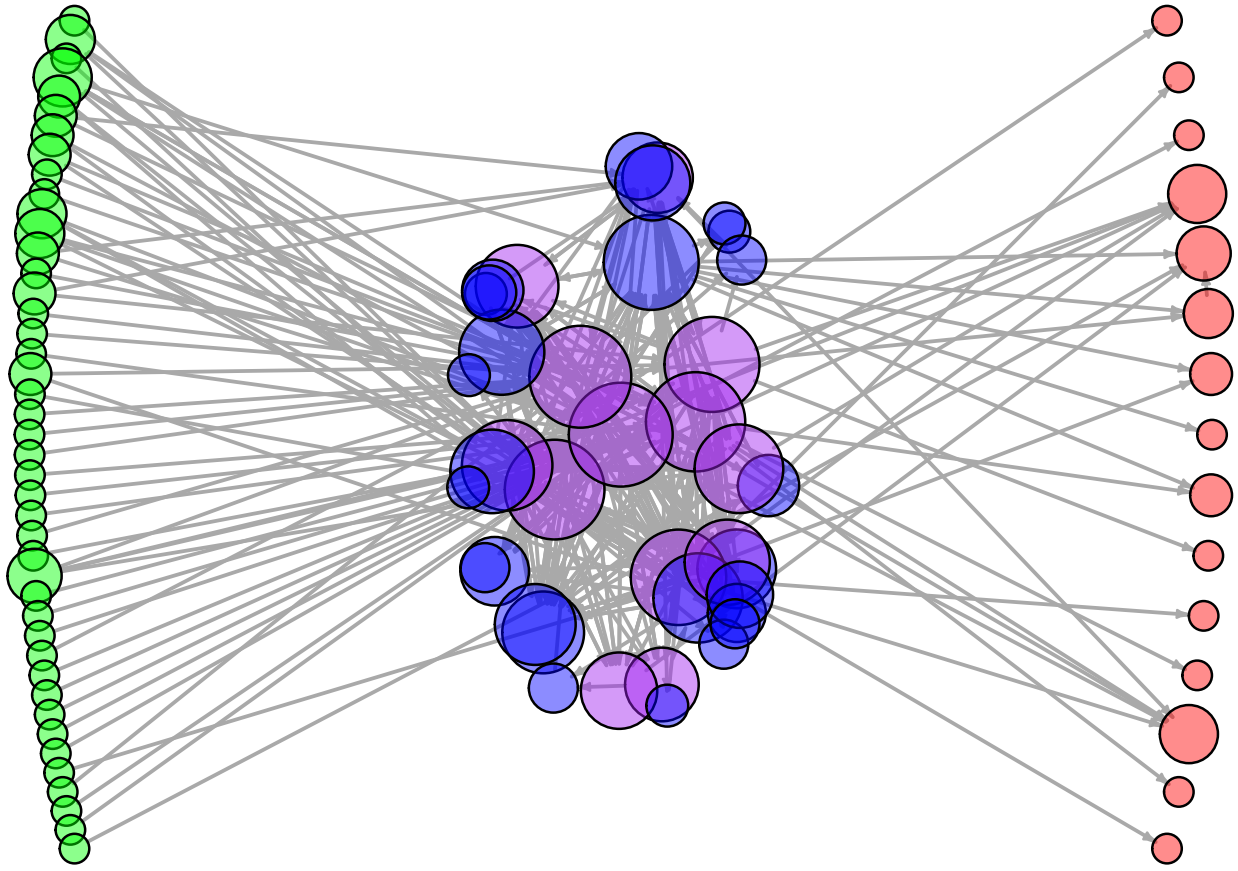
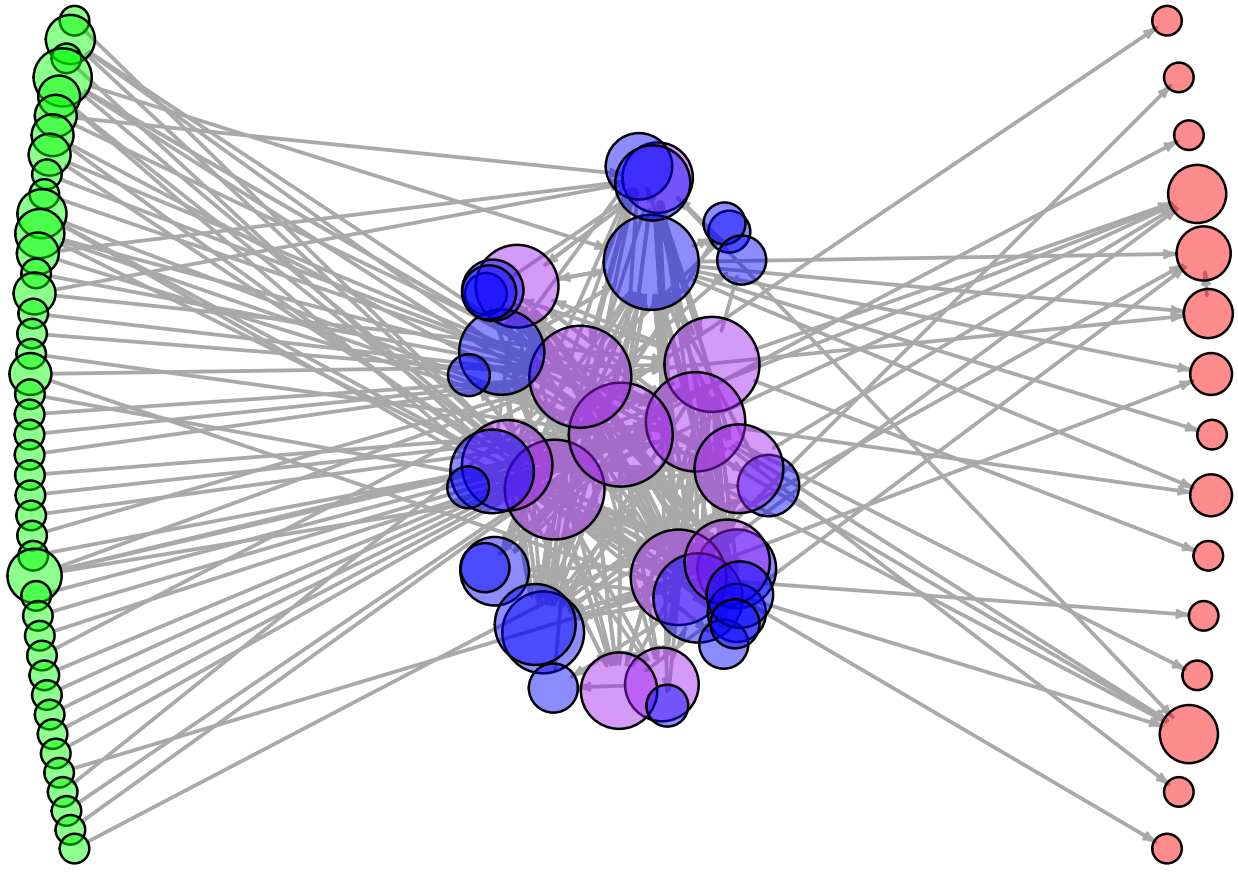


Mapping Financial Markets

Dealers and Customers

Total gross notional: 15.95*Bn* euros



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

Mapping Financial Markets

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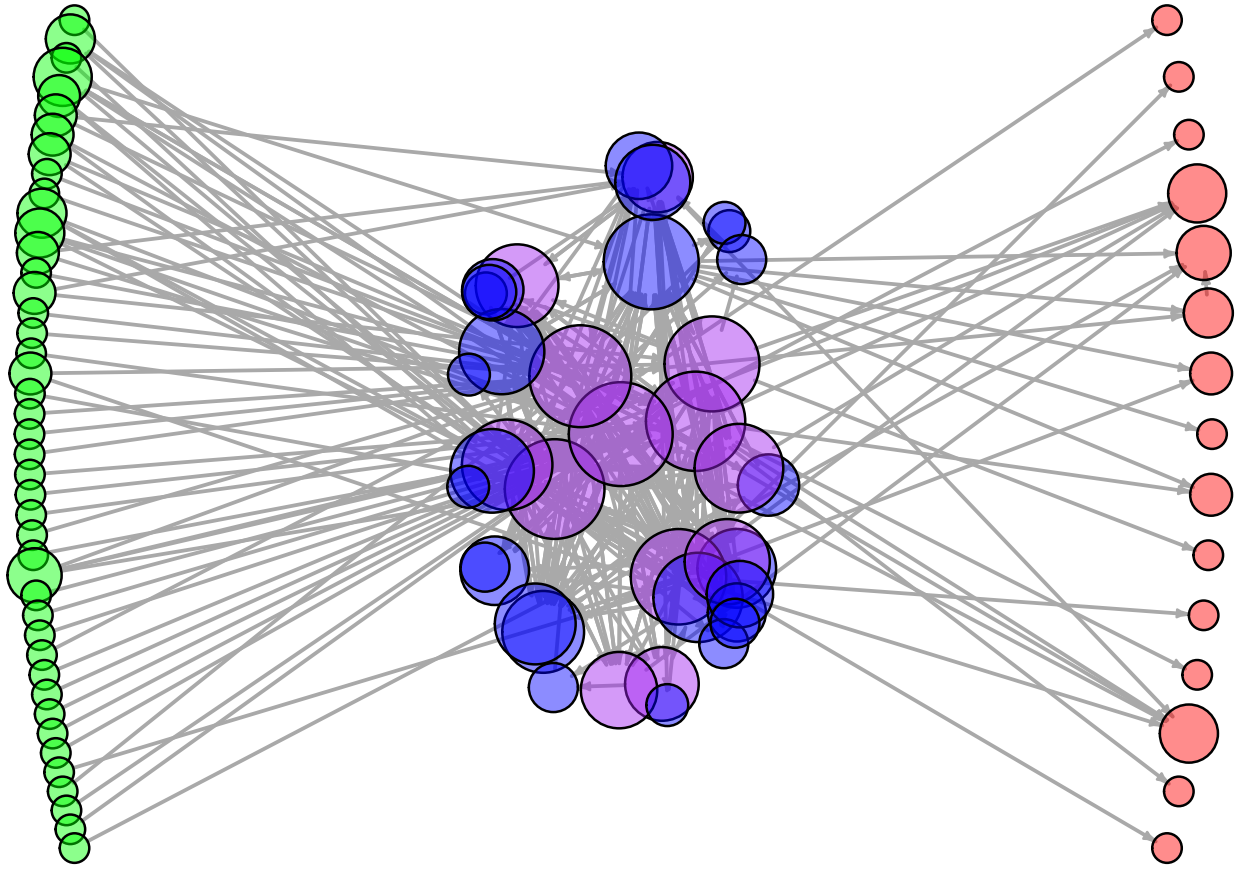
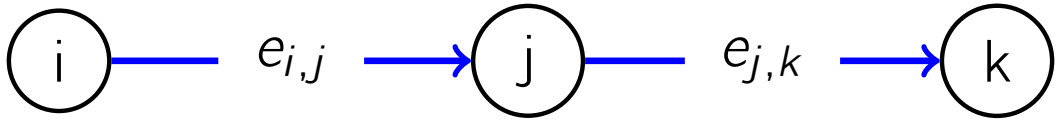


1.6 %	96.6 %	1.9 %
1	0.21 (0.18)	1

Net vs Gross



Excess

$$\Delta = \underbrace{\sum_{i,j} e_{ij}}_{gross\ \ notional} - \underbrace{\frac{\left(\sum_i \left|\sum_j e_{ij} - \sum_j e_{ji}\right|\right)}{2}}_{minimum\ \ notional} \tag{1}$$

Excess

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Theorem

In a market of fungible and outstanding trades:
There is excess $\Leftrightarrow$ *there is intermediation in the market*

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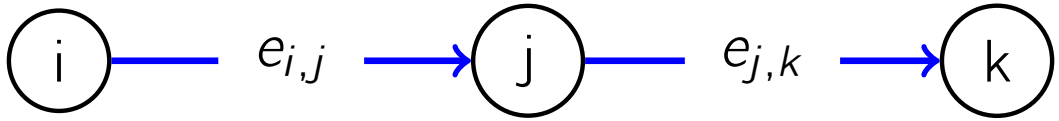
Corollary

Dealers generate the excess in networked markets



Compression

Definition

Operation over the market $G = (N, E)$ that **reconfigures** the web of outstanding trades s.t. the resulting market $G' = (N, E')$

- Preserves net positions → **unchanged market risk**
- Reduces excess → **reduction of counterparty risk**
- Satisfies tolerance levels[1]

↓

Efficiency criteria

Excess Reduction

[1] Tolerance level = arbitrary bilateral constraints

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Efficiency criteria

Excess Reduction

Remark

Compression is a multilateral novation netting technique that does not require the participation of a Clearinghouse or Central Counterparty

[1] Tolerance level = arbitrary bilateral constraints

Classification

2 classes of compression tolerances

Conservative
Relationship constrains

Non-conservative
No constrains

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Feasibility

Classification

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Feasibility

Efficiency

Classification

2 classes of compression tolerances

Conservative	**Non-conservative**
Relationship constrains	No constrains

Feasibility

Efficiency

Solution Characterisation

Results

Necessary and sufficient condition

Theorem

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Results

Necessary and sufficient condition

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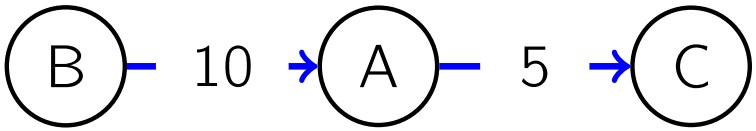

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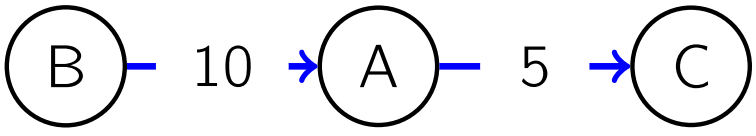

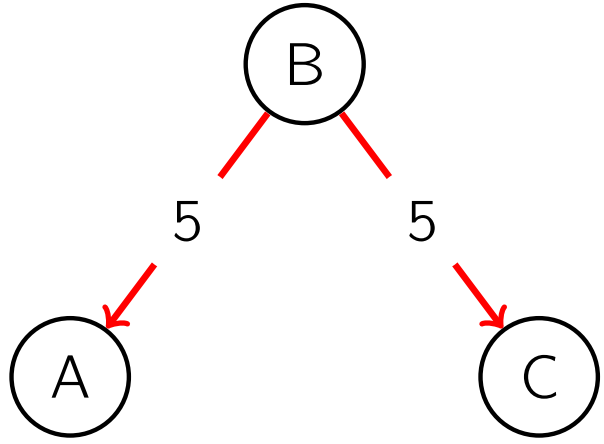

Results

Necessary and sufficient condition

Conservative

Theorem

Conservative compression takes place $\Leftrightarrow$ *there is at least one closed chain of intermediation in the market*

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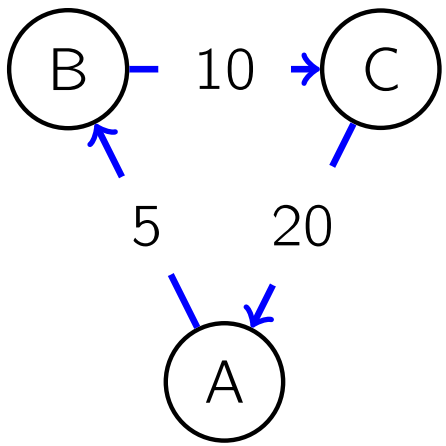
Conservative compression takes place ⇔ there is at least one closed chain of intermediation in the market



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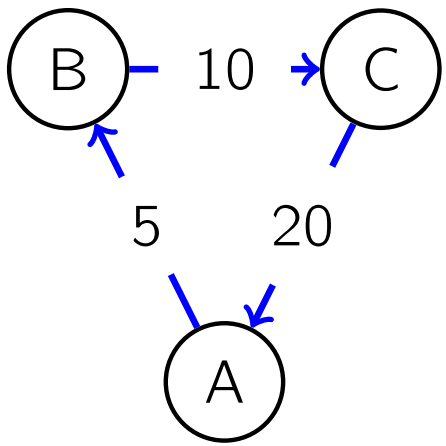

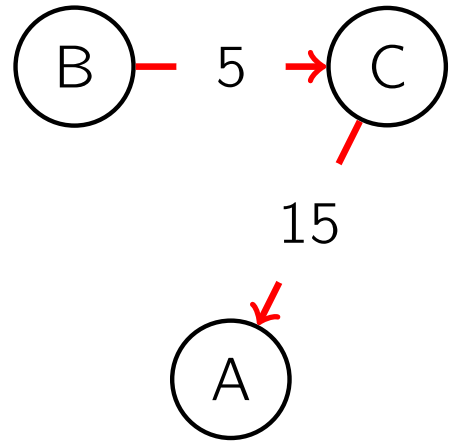

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Non-Conservative

Theorem
Non-Conservative compression can achieve full compression

$\rightarrow$ Excess = 0

Results

Efficiency

Non-Conservative

Theorem
Non-Conservative compression can achieve full compression

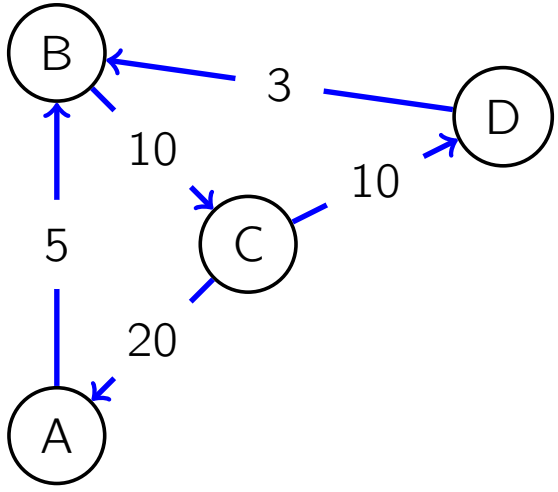
→ Excess = 0

Conservative

(In dealer-customer markets)
Theorem
Conservative compression cannot remove all the excess

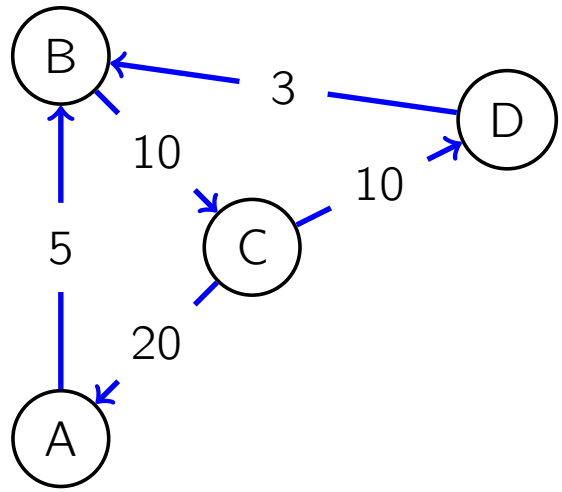
→ Excess > 0

Illustration



Excess = 26

Illustration



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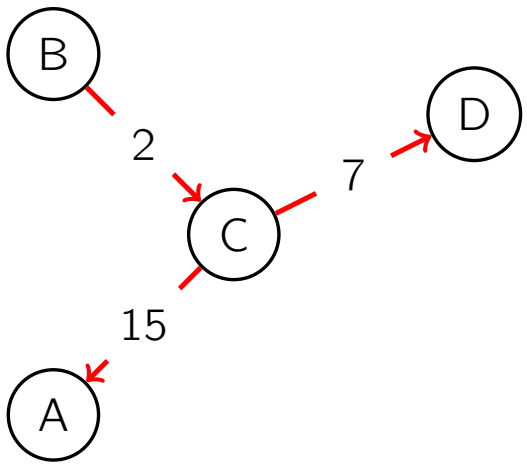
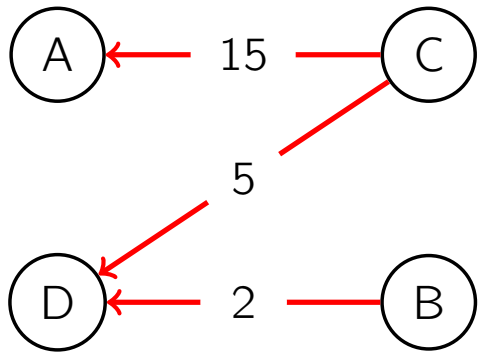


Excess = 2

Non-conservative



Excess = 0

A third approach

Hybrid Compression

Assumptions

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

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Implementation

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

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Theorem

General ranking of efficiency

$$bilateral \leq conservative \leq hybrid \leq non - conservative$$

Application

Data

Trade state report under EMIR: EU-wide Credit Default Swaps

- 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

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

Results

Top 100 markets

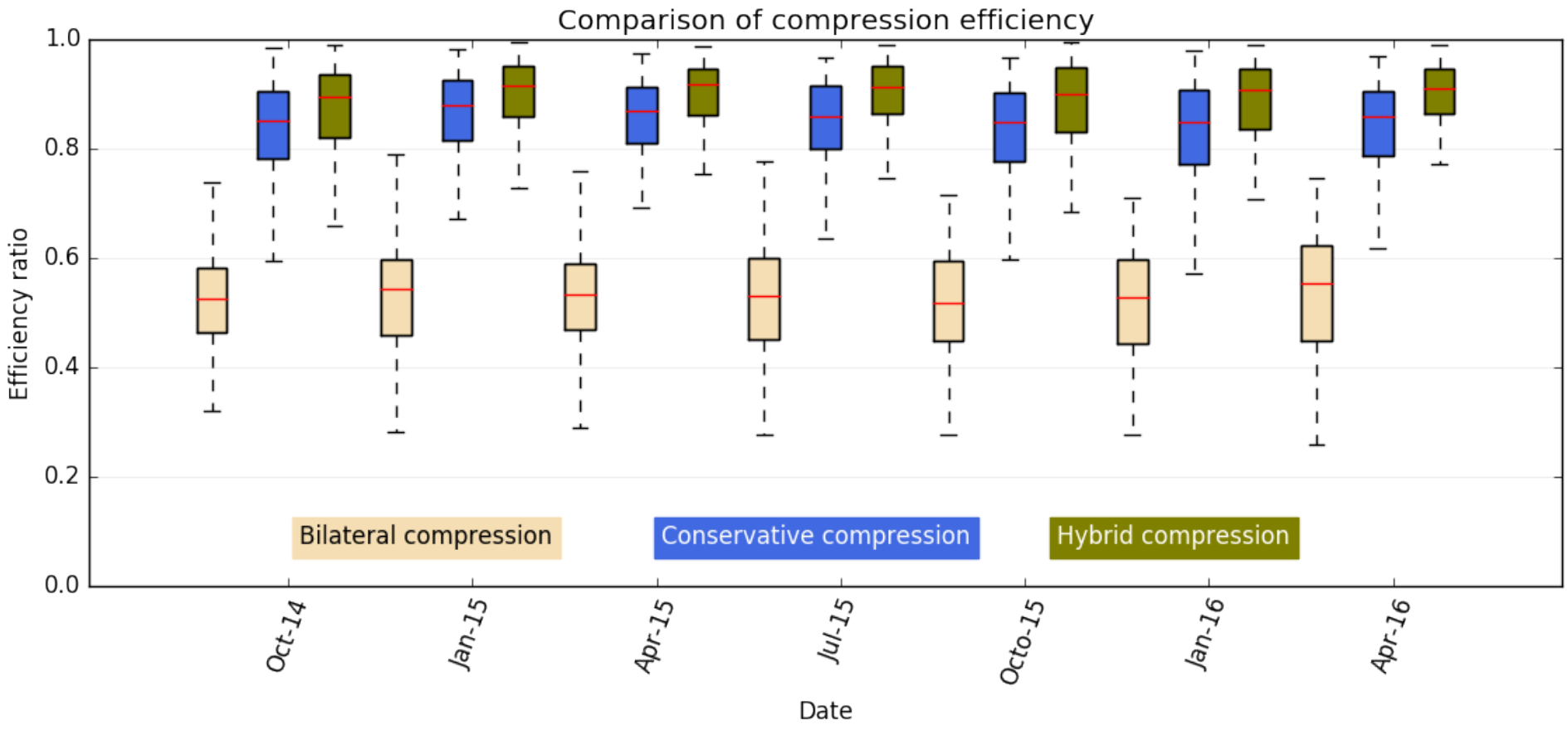
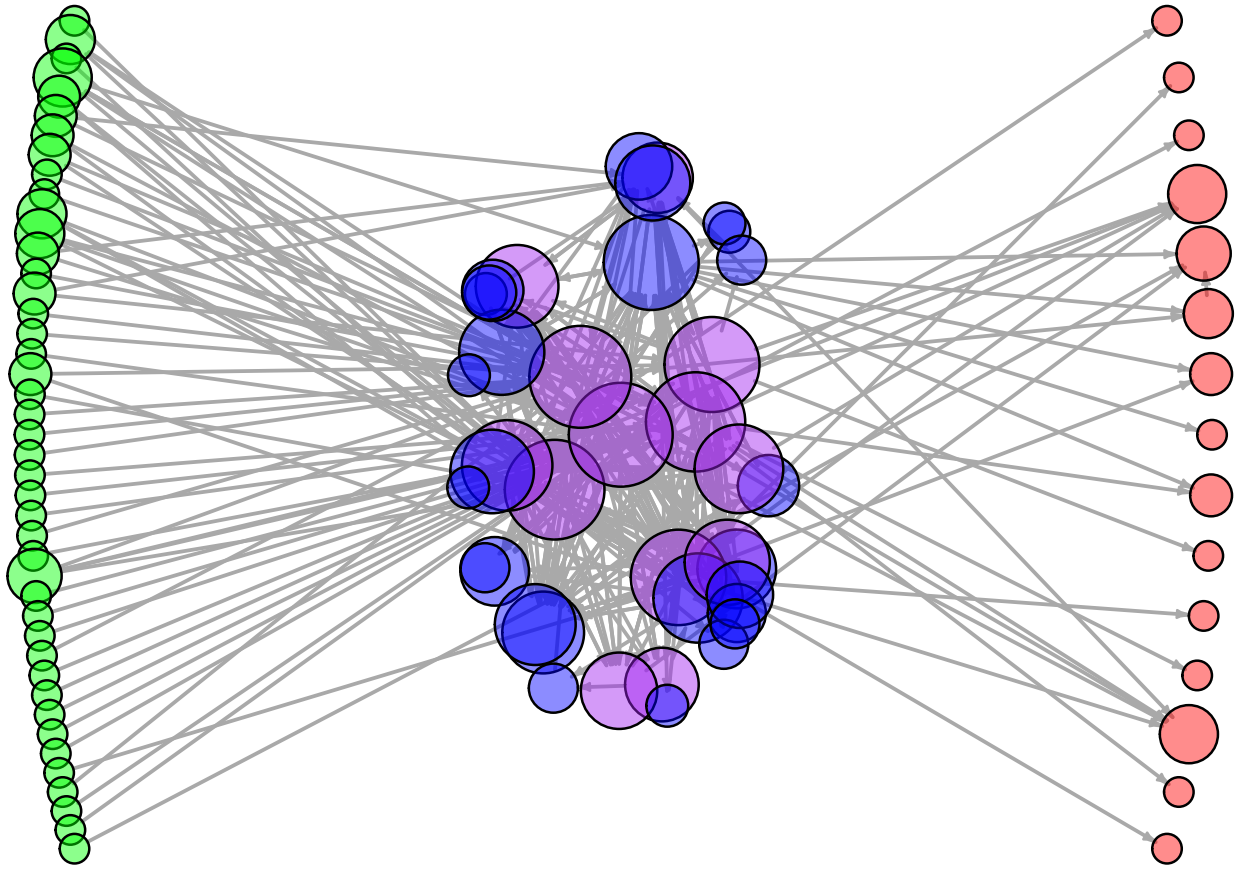


Illustration: concentration effects

Lehman and AIG under conservative compression



Conclusion

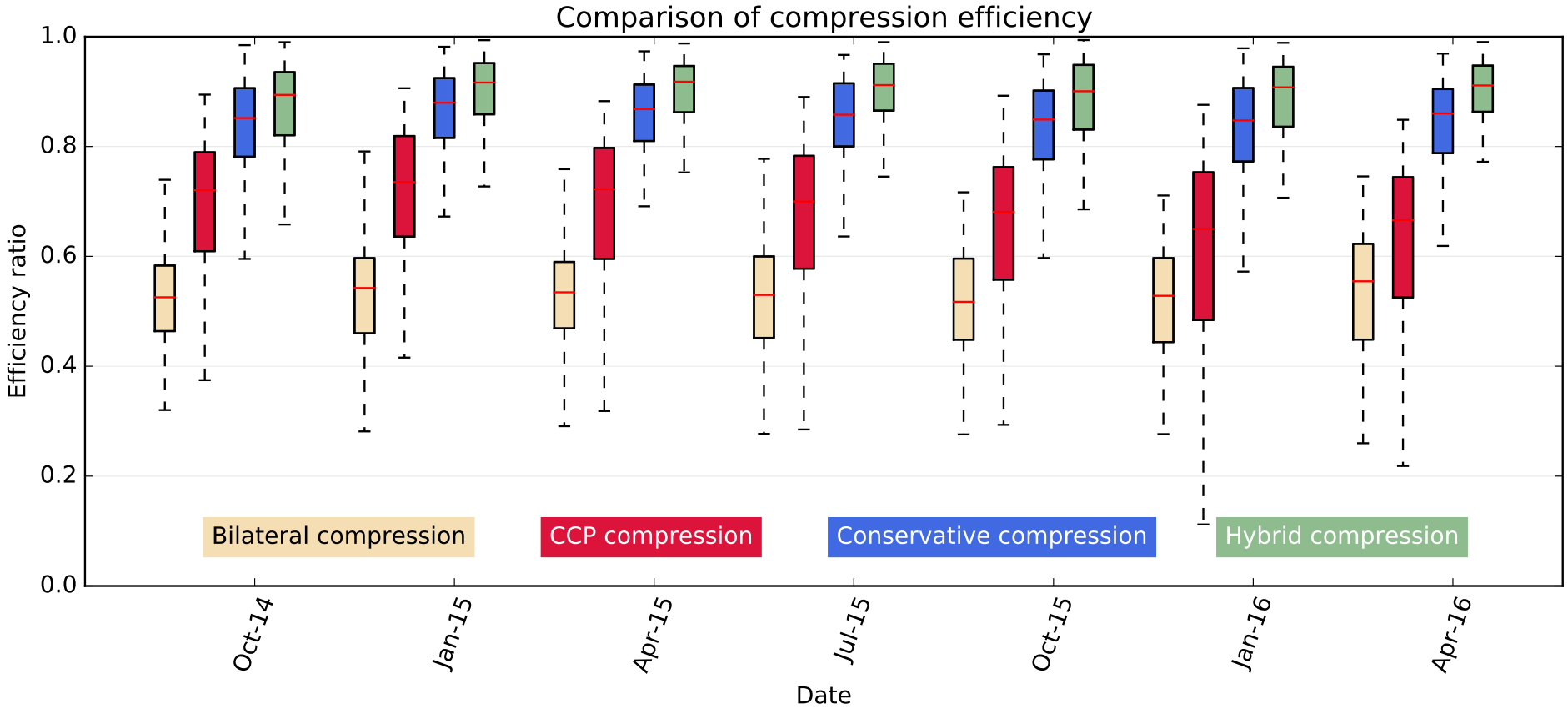
- There is more to **market size**
  - In OTC markets
    → Trades generate **excess** when there is **intermediation**
- Excess can be removed by **compression**
  - Already in place in some **derivatives** markets
- Theoretical understanding of the **mechanics**
  - Tolerances, feasibility, efficiency trade-off, design
- Empirical **application**
  - Large levels of excess, concentration in the intra-dealer segment, efficiency of multilateral approaches despite trade-off

↓

Towards an understanding of the systemic implications of compression

Thank you!

roukny@mit.edu


Comparison of compression efficiency
Efficiency ratio
1.0
0.8
0.6
0.4
0.2
0.0
Bilateral compression
CCP compression
Conservative compression
Hybrid compression
Oct-14
Jan-15
Apr-15
Jul-15
Oct-15
Jan-16
Apr-16
Date