Systemic Risk Management in Financial Networks with Credit Default Swaps

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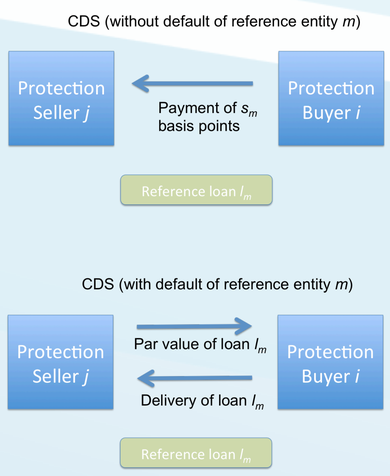
Contribution

- Study insolvency cascades in an interbank system when banks insure their interbank loans with credit default swaps (CDS)
- A regulator imposes a systemic surcharge (i.e. tax) on CDS contracts according to how much they contribute to increasing systemic risk
- This effectively 'rewires' the interbank system and leads to a more resilient configuration (with lower systemic risk)

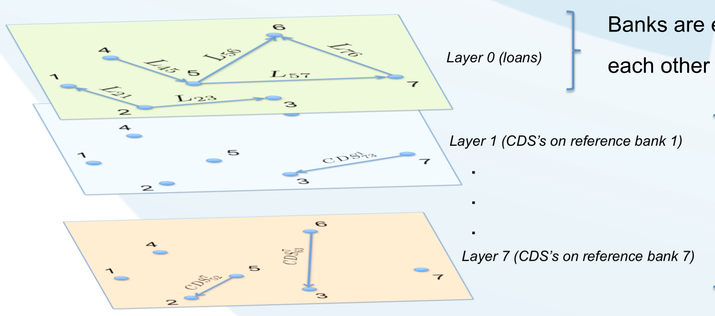
Credit Default Swaps (CDS's)

- A CDS contract CDS_{ij}^{m} is an insurance contract on a reference entity (bank)

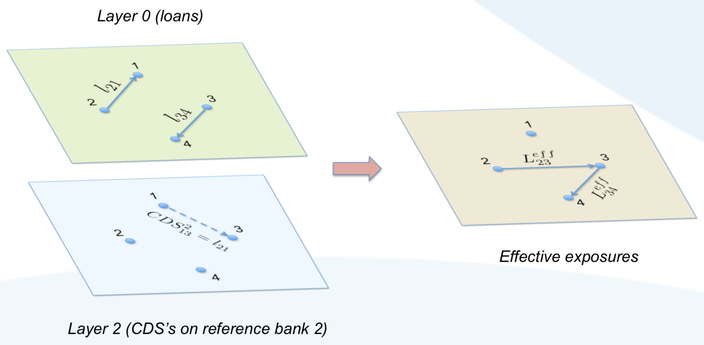


- An interbank loan can thus be insured using a CDS contract

CDS's 'Rewire' the Interbank System

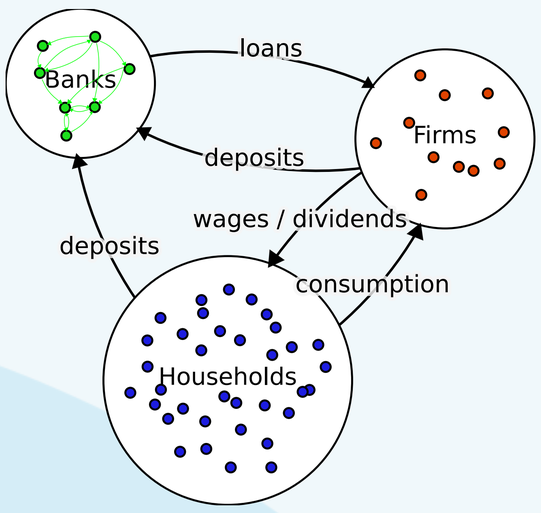


Interbank Network as a Multi-Layer Network



Multi-Layer Network Mapped into a Single 'Rewired' Layer of Effective Exposures

Agent-Based Model of Interbank System



Controlling Network Formation with a Systemic Surcharge

- Sytemic importance of a bank *i* can be measured by DebtRank: $R_i(L^{eff}, C)$ (Effective exposures layer; Capital buffers)

$R_i(L^{eff}, C)$ is the fraction of the value of the banking system that is lost following bank *i* 's default

- This leads to the expected systemic loss: $EL^{syst} = \sum_{i=1}^{B} P_i^{def} V R_i(L^{eff}, C)$ (P_i^{def}: Exogenous default probability; V: Total value of banking system)
- Incremental effect of a CDS contract on systemic risk is easily computed:

$$\Delta^{(+CDS_{ij}^{m})} EL^{syst} = EL^{syst,(+CDS_{ij}^{m})} - EL^{syst}$$

- CDS contracts are now priced according to how much they contribute to systemic risk

$$s_{ij} = s_m + \tau_{ij} \quad \text{where} \quad \tau_{ij} = \zeta \cdot max\left[0, \Delta^{(+CDS_{ij}^{m})} EL^{syst}\right]$$

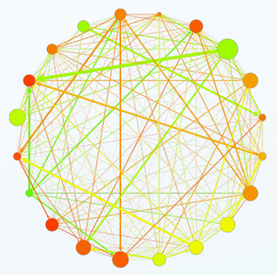
(s_{ij}: Effective 'price' of a CDS; s_m: 'price' of CDS; τ_{ij}: Systemic surcharge)

CDS contracts are 'taxed' according to how much they increase systemic risk. If they decrease systemic risk, they are not taxed.

Results Simulated with the Agent-Based Model

Interbank Networks of Effective Exposures under Different Scenarios:

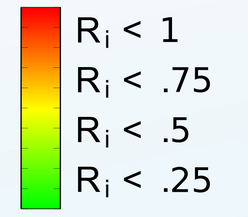
Without a CDS market



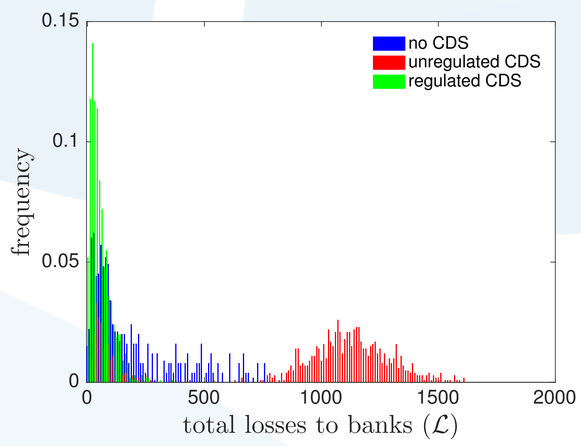
With Tobin tax on interbank loans

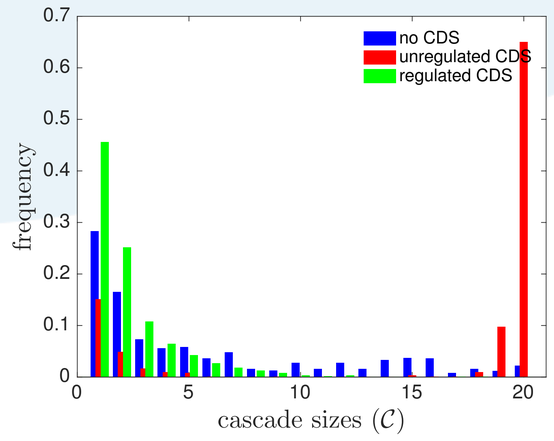
With an Unregulated CDS market

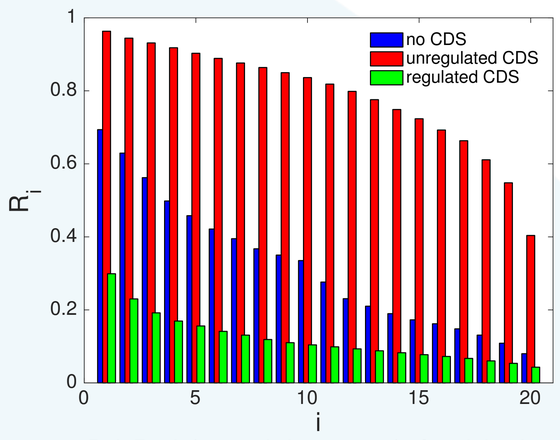
With a regulated CDS market



Color code for DebtRank (systemic importance)







DebtRank (systemic importance) of each bank

Discussion

A CDS market regulated with this tax mechanism effectively 'rewires' the interbank system into a more resilient configuration. Each bank has lower systemic importance (lower DebtRank) and thus causes less damage to the interbank system following its default. An unregulated CDS market however increases systemic risk as it creates more contagion channels.