Liquidity risk in Securities Settlement

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Motivation

- Contagion in SSSs possible (E.g. Sept 11)

- Existing studies of contagion limited
  - Payment systems, not SSSs
  - Actual stress tests in SSSs

- SSSs are different from payment systems
  - Securities leg $\Rightarrow$ -liquidity provision is not enough
  - Settlement lag $\Rightarrow$ -need to form expectations about holdings
    -disruption lasts more than one day

What we do

- Develop a methodology ...
  - Multiple-period model, multiple securities
- to asses the impact of a "stress event" ...
  - Default of the largest participant
- on liquidity risk...
- from a system wide perspective.
  - Look at settlement efficiency and trade volume

Liquidity risk and settlement efficiency

- Liquidity risk
  - "*the risk that a counterparty will not settle an obligation for full value when due, but some unspecified date thereafter*" (BIS, 1992).
- Settlement efficiency as a proxy for liquidity risk
  - Ratio of trades settled over total trades (in values)
- Also, fall in volume of trades after disruption

Questions addressed

- What are the dynamic effects (direct and contagion) on settlement of a major disruption?
- How does first-day impact compare with impact in subsequent days?
- How many days does it take before settlement efficiency returns to its "normal" level?
- How important is liquidity provision for avoiding problems?

Outline

- Existing literature
- Stylised example
- Model description
- Simulation results
- Conclusions

Existing literature

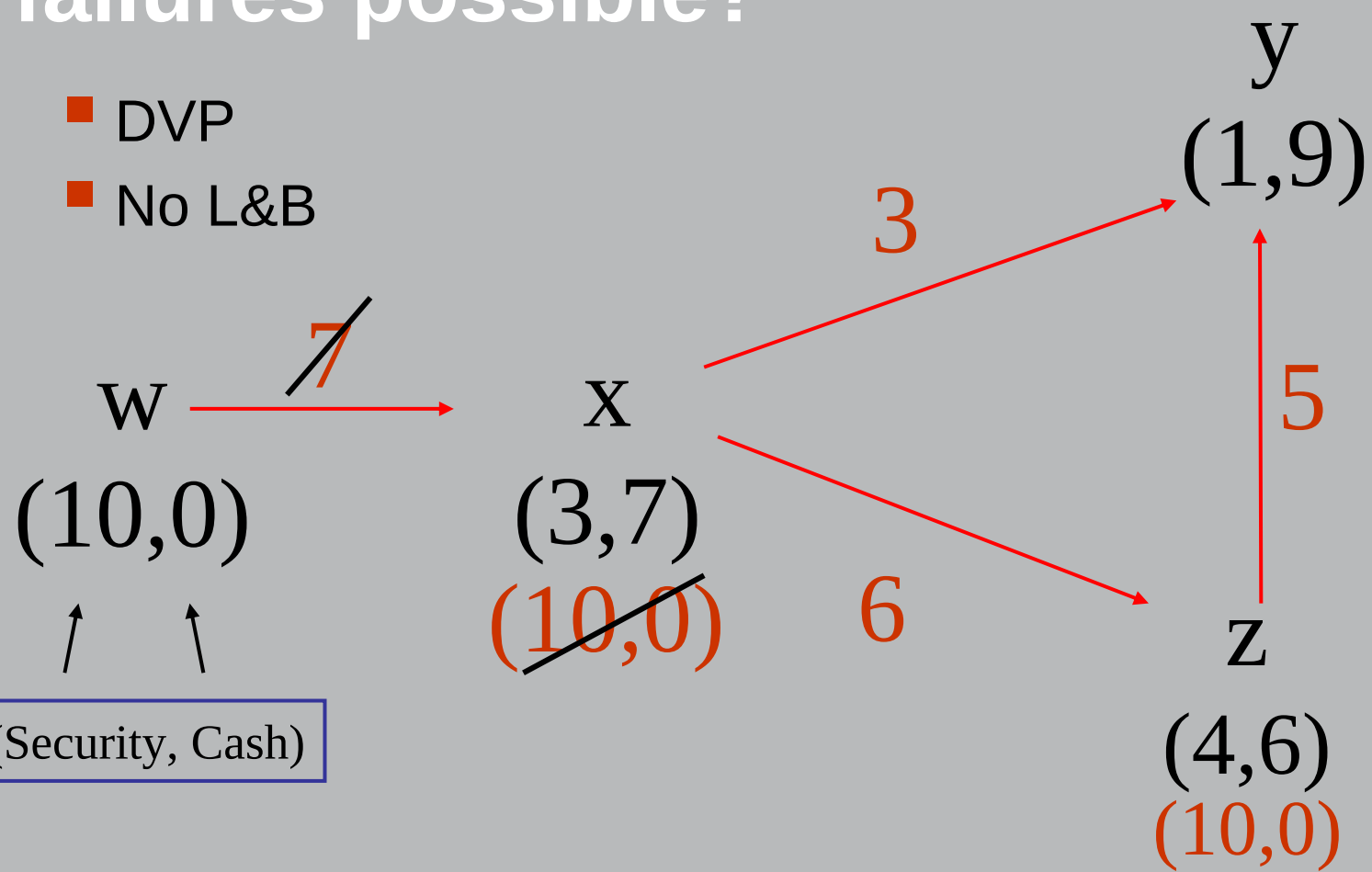
- Interbank market
  - Solvency: Upper and Worms (2002), Furfine (2003), Degryse and Nguyen (2004)
- Payment systems
  - Liquidity: Humphrey (1986), Angilini, Maresca and Russo (1996), Northcott (2002)
  - Net vs. gross settlement: Kahn, Mcandrews and Roberds (1999), Leinonen and Soramaki (1999)

⇒ Intraday liquidity solves all problems

- Securities settlement
  - Operational risk: Ioro (2004)

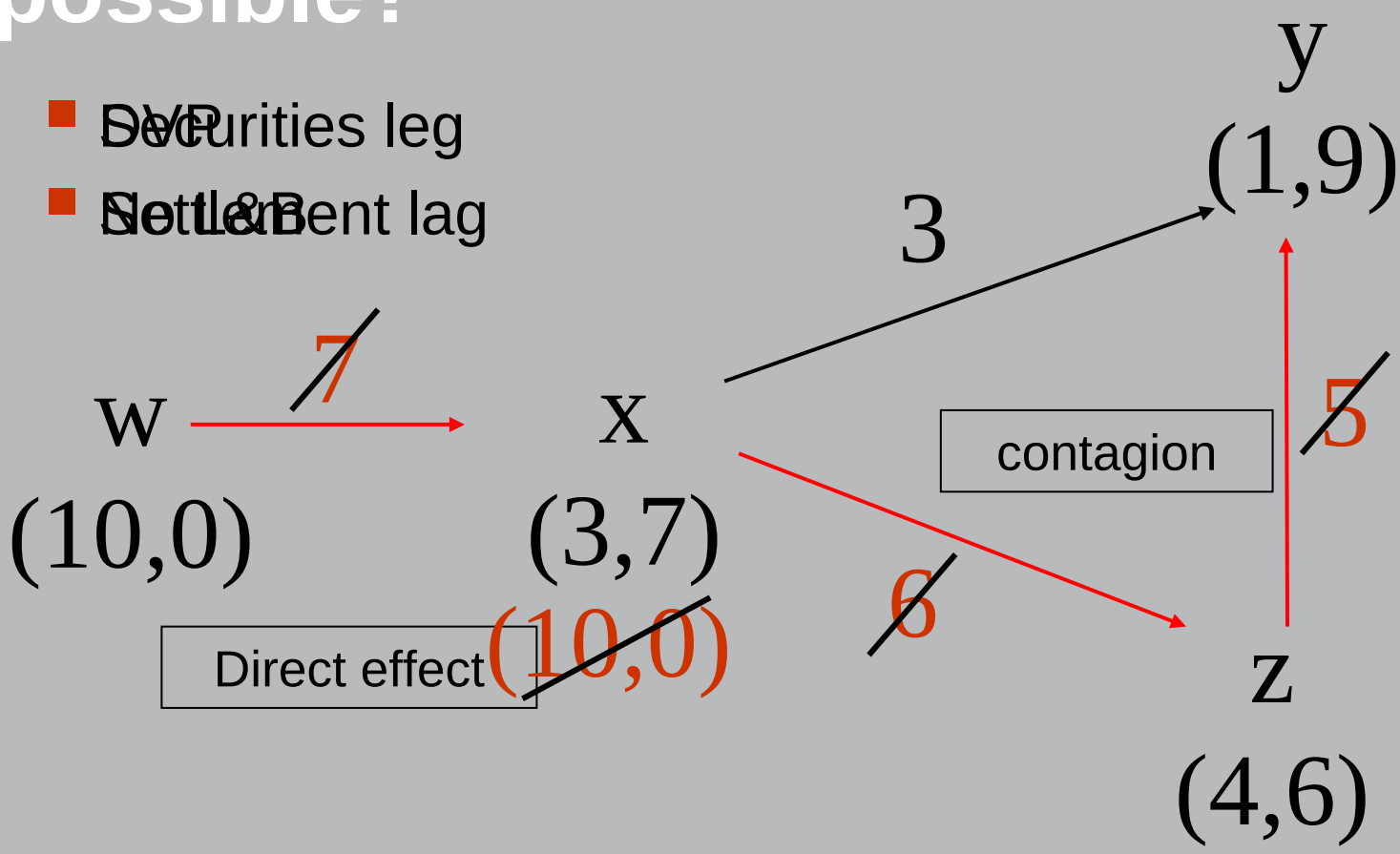
Example: Why are settlement failures possible?

- DVP
- No L&B



Why are settlement failures possible?

- DVP
- Securities leg
- Settlement lag

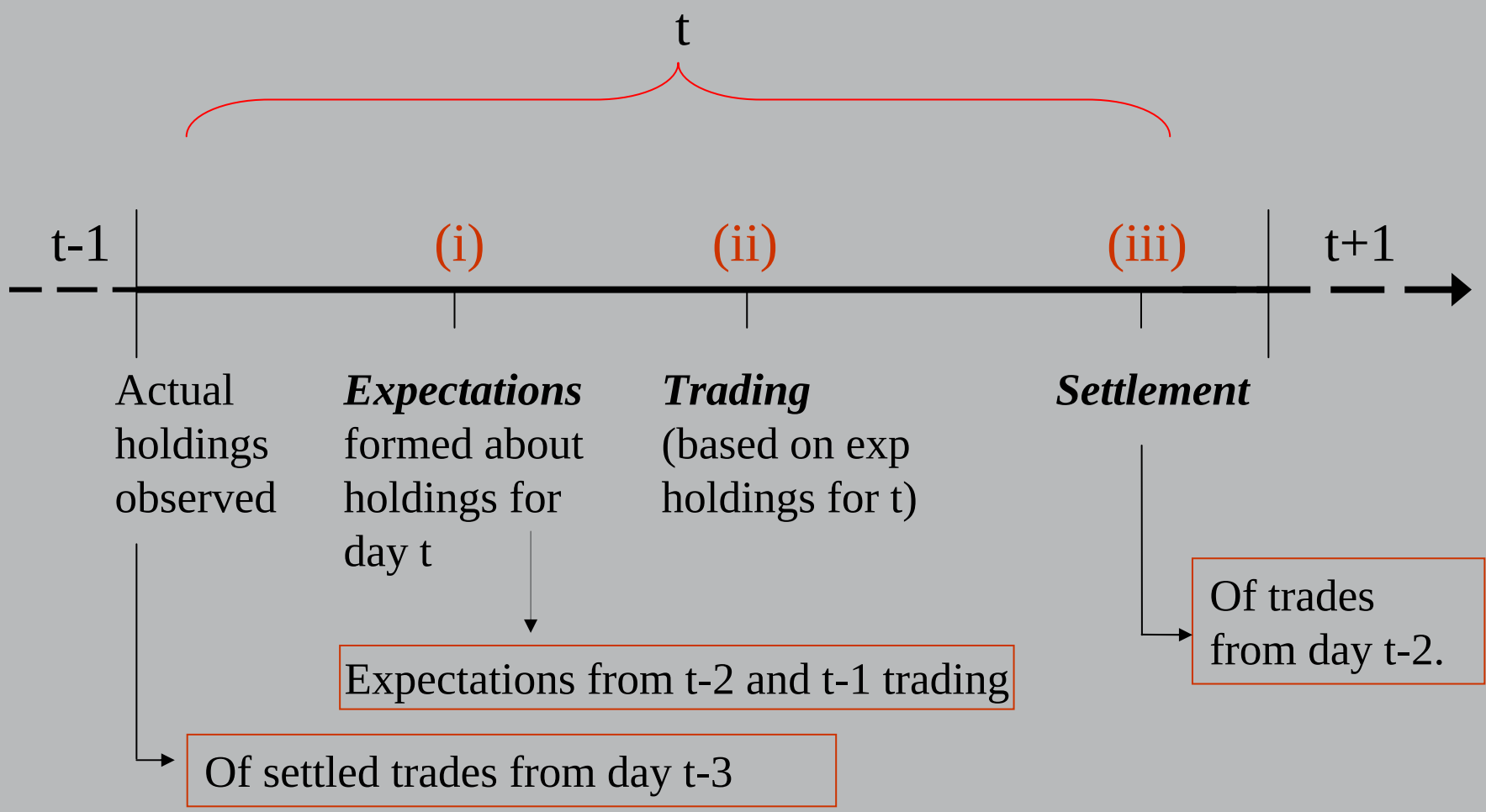


Model

- N participants; K securities; Gross settlement; Two-day settlement lag
- Quantity and price of each security normalised to 1.

- Initial allocations of securities: two possible schemes
  - "*Diversified*": Each participant receives 1/N of each security
  - "*Concentrate*d": Entire qnty of each security allocated randomly to a participant
  - For each scheme: Cash = 5% of total assets

Model: Timing of events on day t



Expectations – Trading – Settlement

- "*Normal periods*" (before default): Participants assume that all previous trades will settle
  - No settlement failures occur
- "*Crisis periods*" (after default): Participants reduce expected holdings for day *t* by γ % of failures from settlement on day *t-1*
  - Expected holdings $\downarrow$ as previous settlement failures $\uparrow$
  - $0 \leq \gamma$; $\gamma = 0 \Rightarrow$ no adjustment of expected holdings
  - γ may be > 1

Expectations – *Trading* – Settlement

- Random choice of two counterparties and a security
- Use expected holdings of cash and securities to determine set of feasible trades
- Random draw of a trade from feasible set
- Update expected holdings after each trade

Expectations – Trading – *Settlement*

- Two-day lag: day *t-2* trades settled at end of day *t*
- Uses actual asset holdings after day t-3 trades
  - Determined by settlement at end of day t -1
- Unsettled trades put in a queue
- Credit available during settlement
  - credit line = % initial value of total assets
  - different credit limits in different scenarios

Intial Shock

- Largest participant fails at end of day D
  - CPSS recomendation
  - Practice in real stress tests
- Unsettled trades with defaulter deleted
- Anticipated by other participants during day D
  - Do not trade on day D with defaulting participant
- Participants adjust expected asset holdings

  (1) Delete unsettled trades with defaulter (direct effect)

  (2) Reduce expected holdings for indirect effects

Settlement efficiency

- Total settlement efficiency

$$\frac{\text{Value of settled trades}}{\text{Value of total trades}}$$

- Indirect settlement efficiency

$$\frac{\text{Value of settled trades}}{\text{Value of trades excluding defaulter}}$$

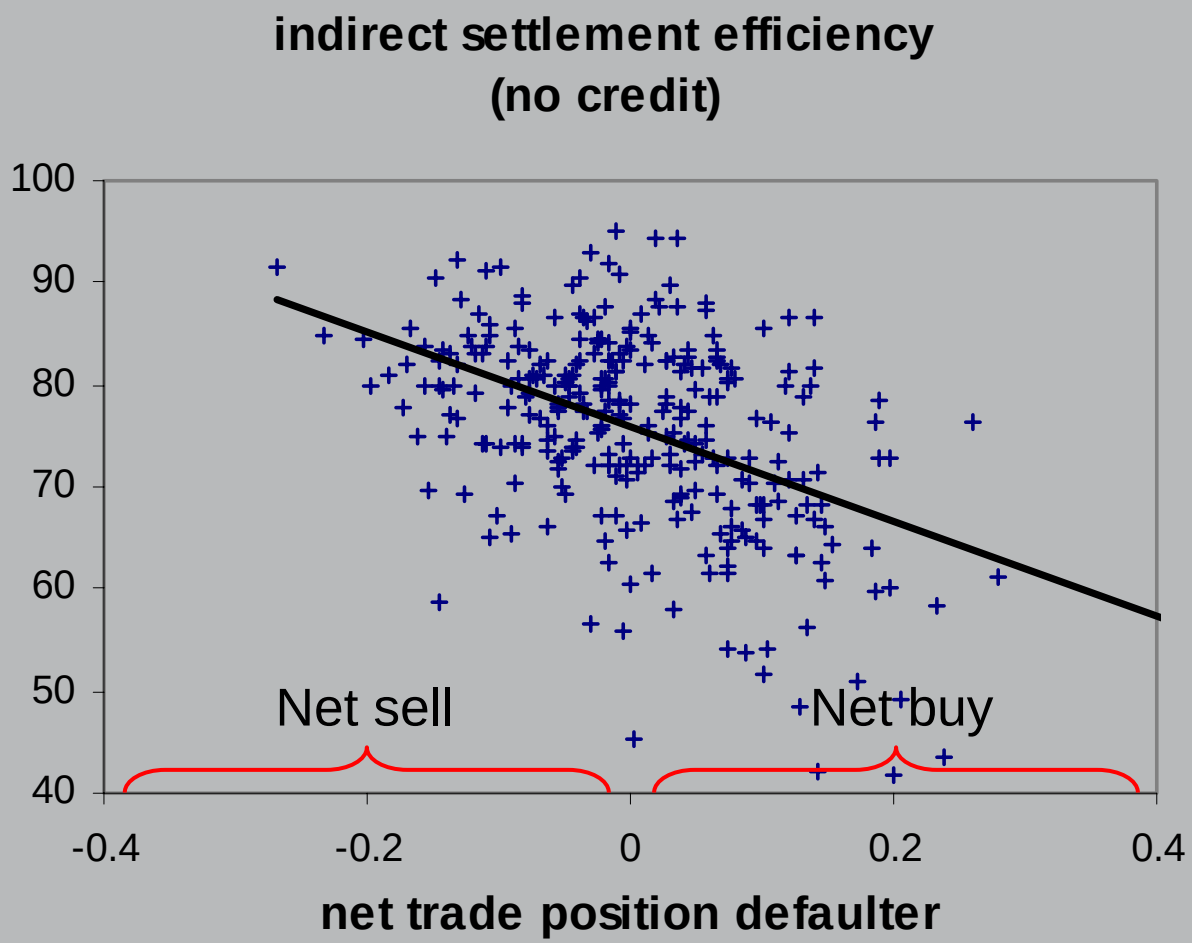
Simulation results: First day impact

Settlement efficiency on day D

Credit limit (%assets)	Initial allocation	Total settlement efficiency	Indirect settlement efficiency
0	concentrated	57.84	75.69
	diversified	70.2	80.95
50%	concentrated	72.27	94.89
	diversified	83.95	96.99
100%	concentrated	72.19	94.926
	diversified	83.99	96.97

Results reported for K=30, N=15

Trade position of defaulter



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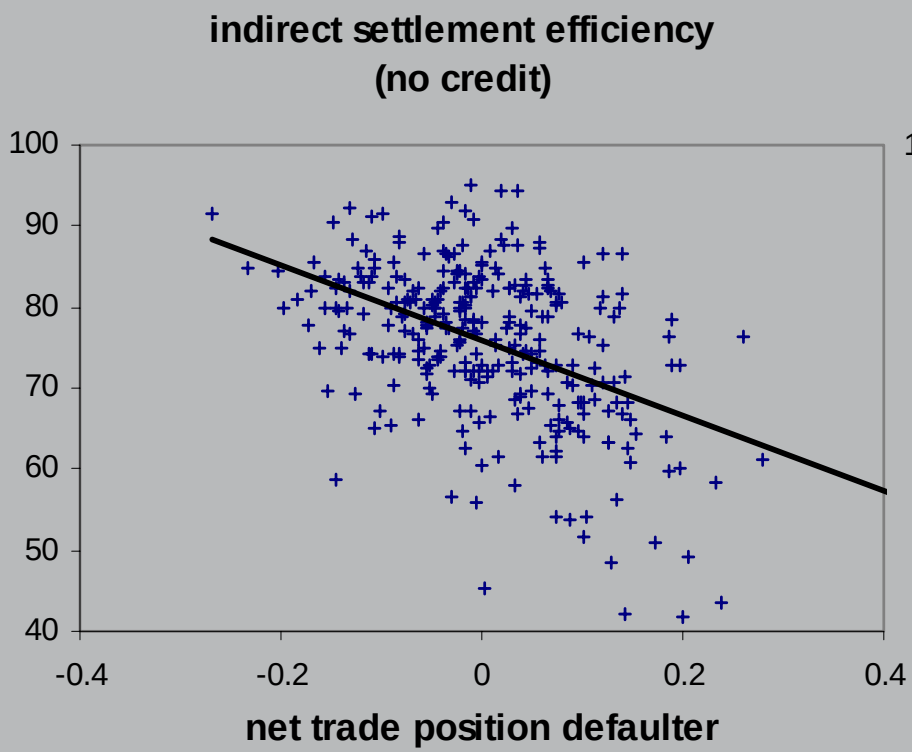
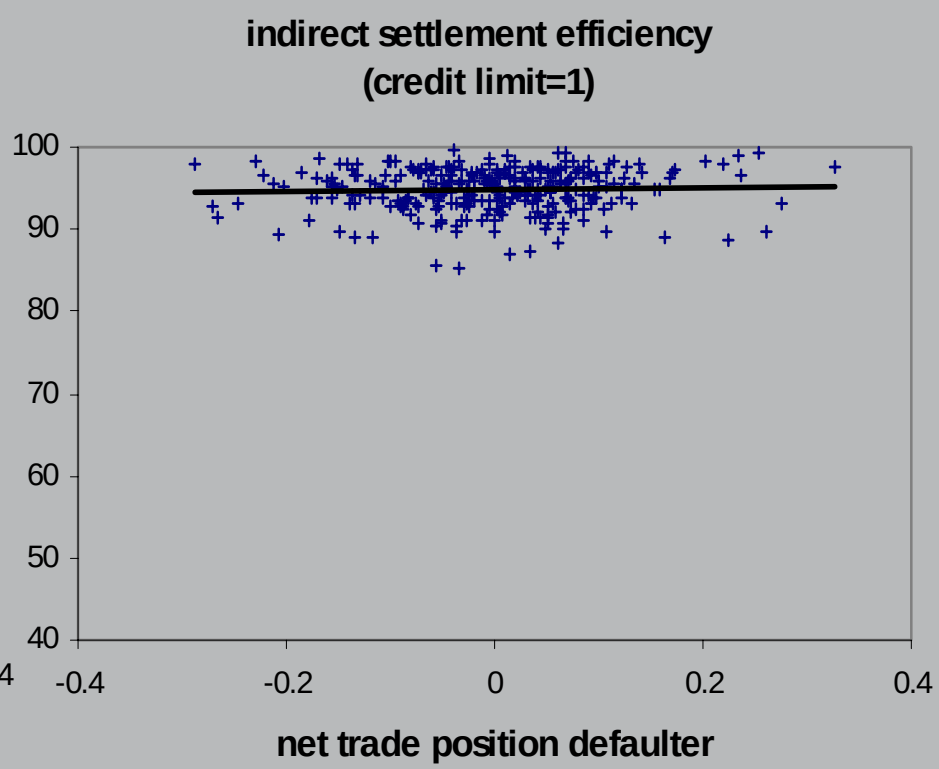
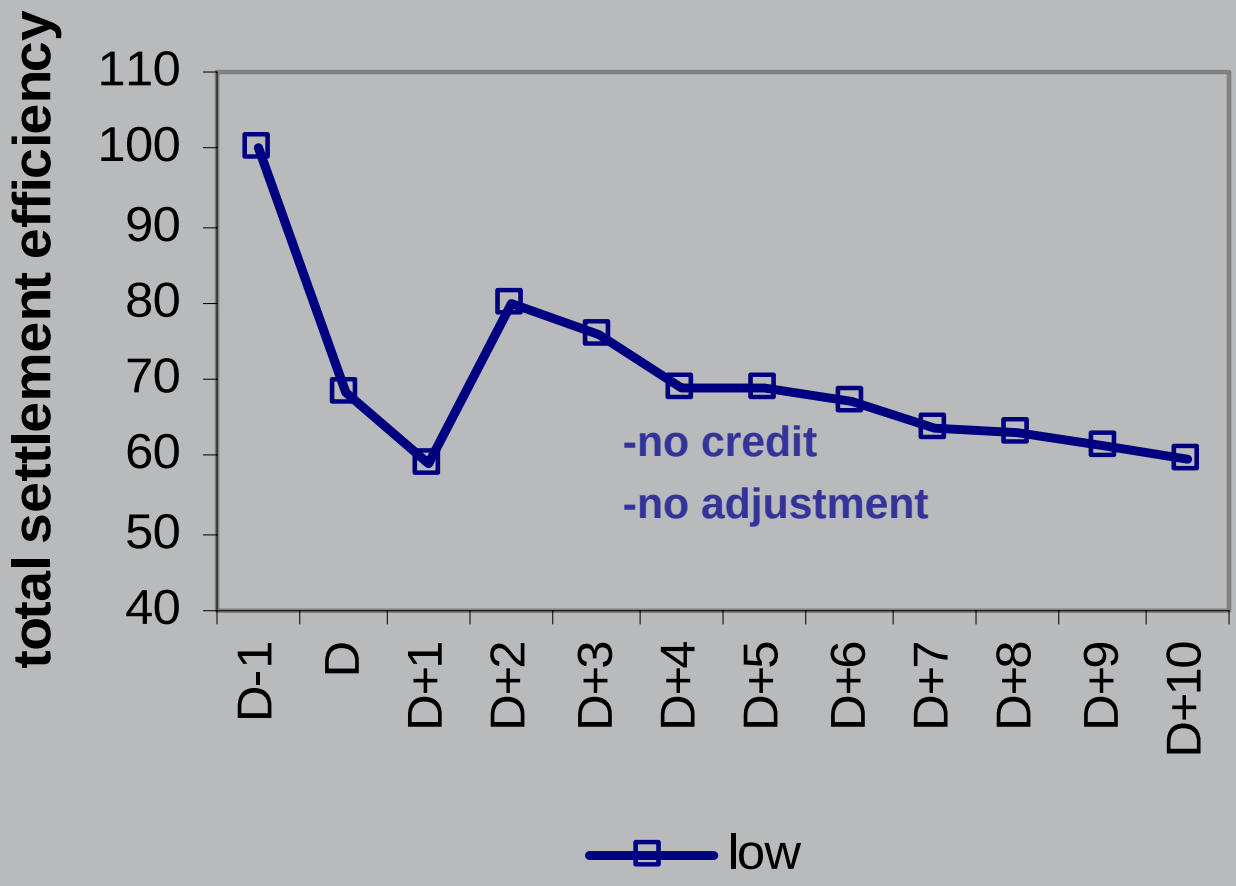




Length of a crisis

- Multiple day crisis
- Largest impact on D+1
- Continuing contagion



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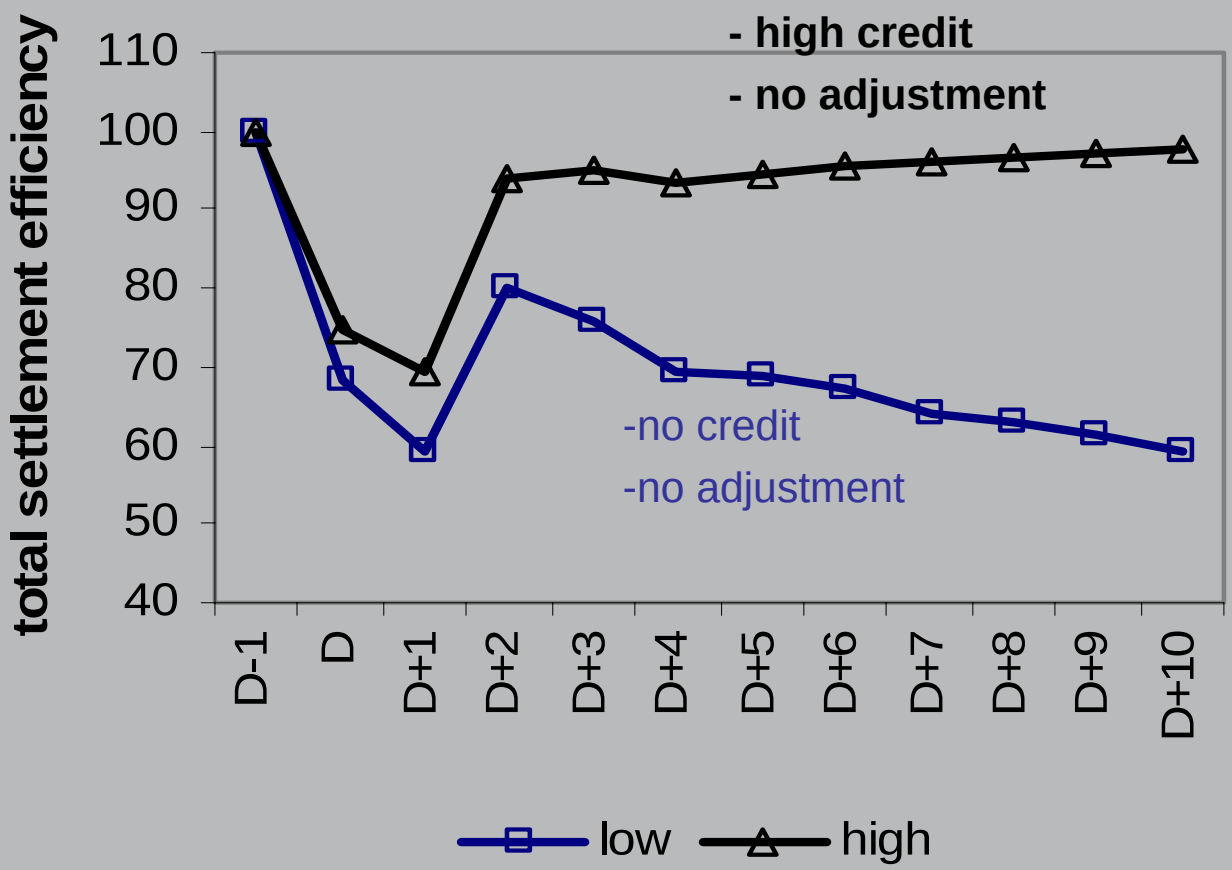
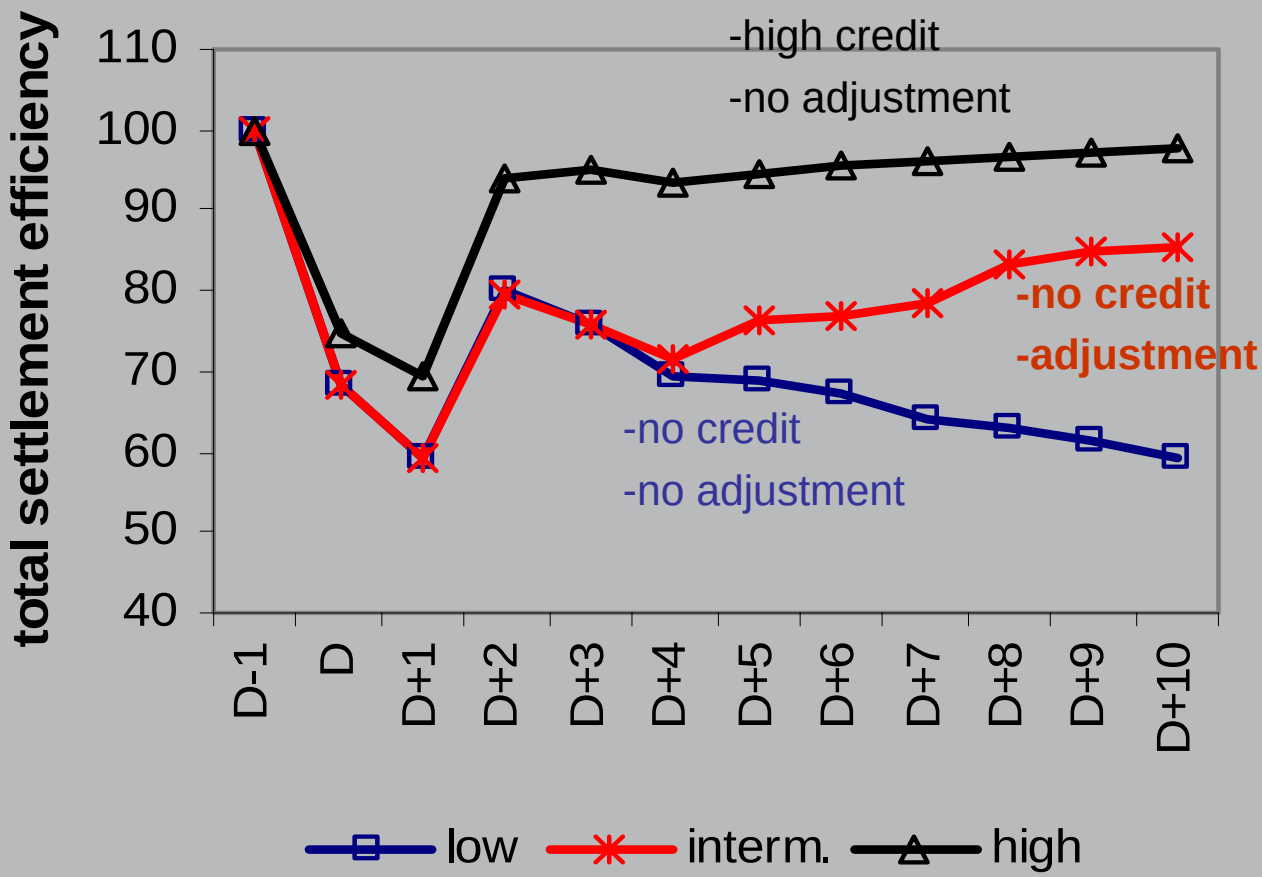


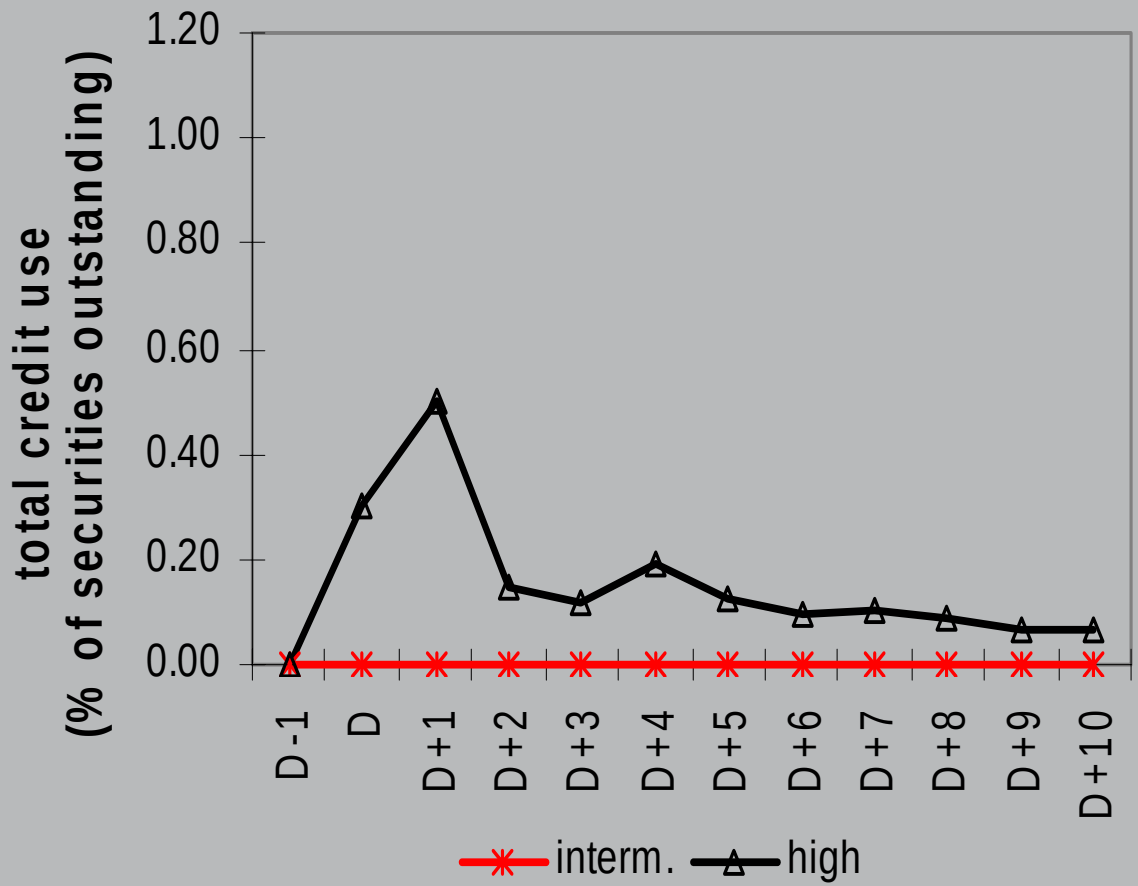
- Liquidity important
- ... but does not eliminate settlement failures

Length of a crisis



- Liquidity and expectations: partial substitutes

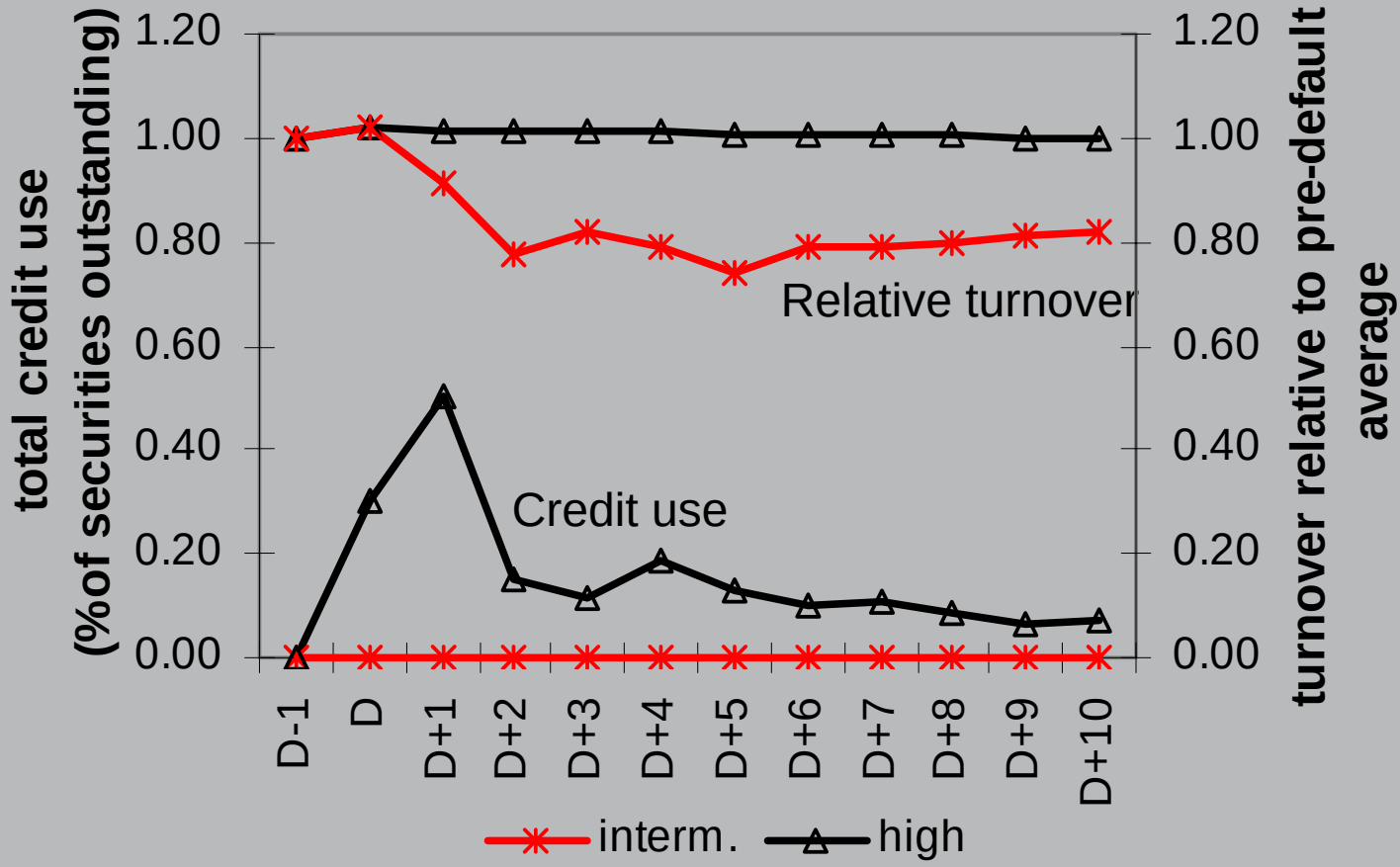
Credit use



- Peak usage on D+1
- > 50% assets
- Well above 10% assets for longer period

Trading volume

- Adjustment of trades = turnover ↓



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Conclusions

- Even with DVP, large settlement failures possible
- Disruptions last longer than a day
  - Crisis worsens before improving
  - Disruption may last longer than the length of the settlement lag
  - Policy makers should not focus only on first-day impact
- Liquidity provision can lower settlement failures
  - *But*, providing enough liquidity may be costly
  - Liquidity cannot eliminate settlement failures
- Liquidity and participants' reduction of trades partial substitutes
  - *But,* reduction of trade volume may cause market liquidity to ↓

Conclusions

- Other options for lowering settlement failures
  - Shortening settlement lag
  - Securities borrowing and lending program

- Improving existing stress tests
  - Multiple days
  - Dynamic (included reactions of participants)
  - System wide perspective
  - Settlement efficiency + turnover