Simulation of participant-level operational disruption in Swiss Interbank Clearing:

Significant systemic effects and implications of participants' input behaviour

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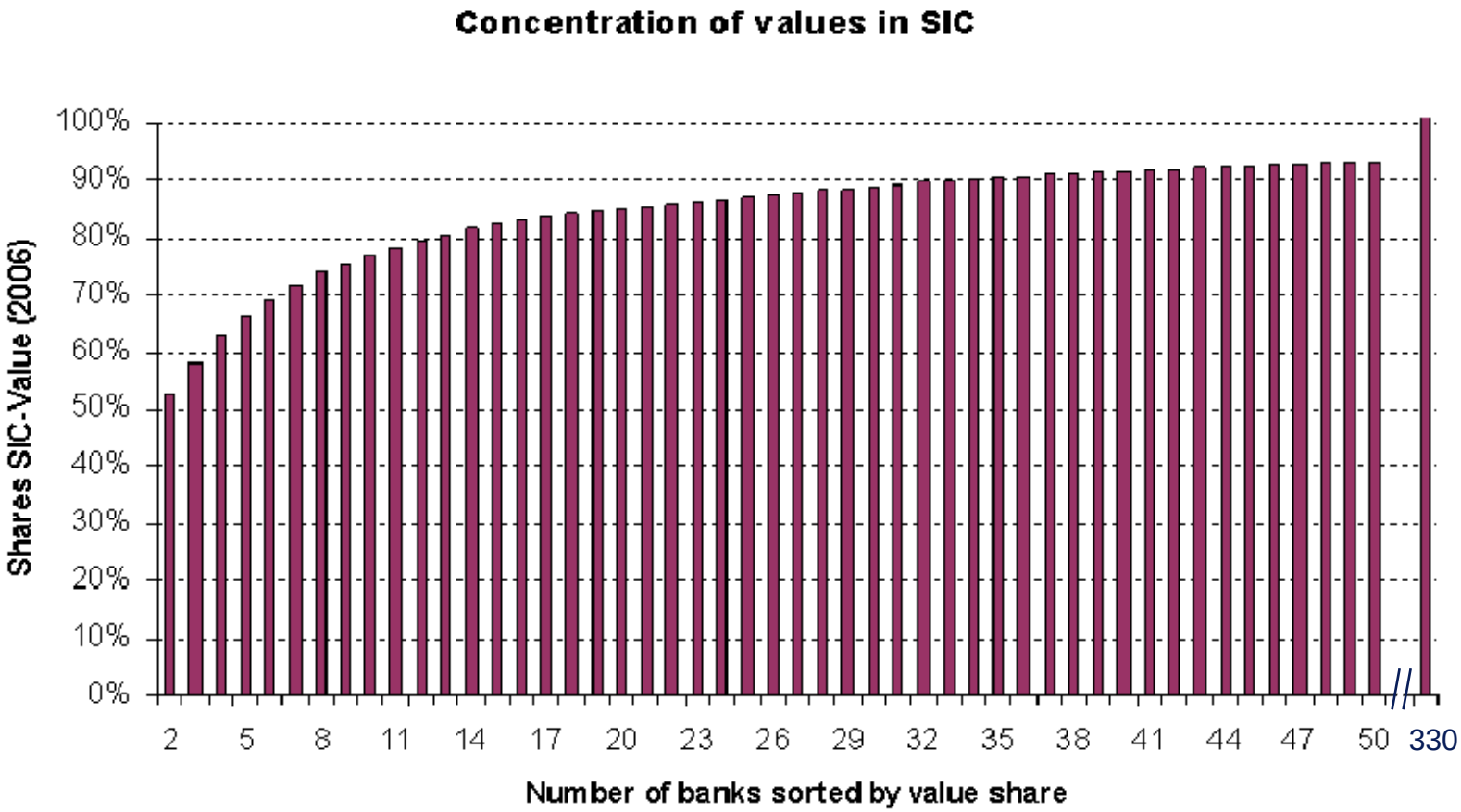
Swiss Interbank Clearing System (SIC)

- no-frills RTGS with centralized queue, FIFO
- used for large and small value payments

▪ Daily values settled (2006, CHF)	179 bn (av.)	318 bn (max.)
▪ Daily number of trx (2006)	1.3 mio (av.)	3.8 mio (max.)
▪ Average transaction size (2006, CHF)	~140 000	
▪ Median transaction size (May 2004, CHF)	~600	

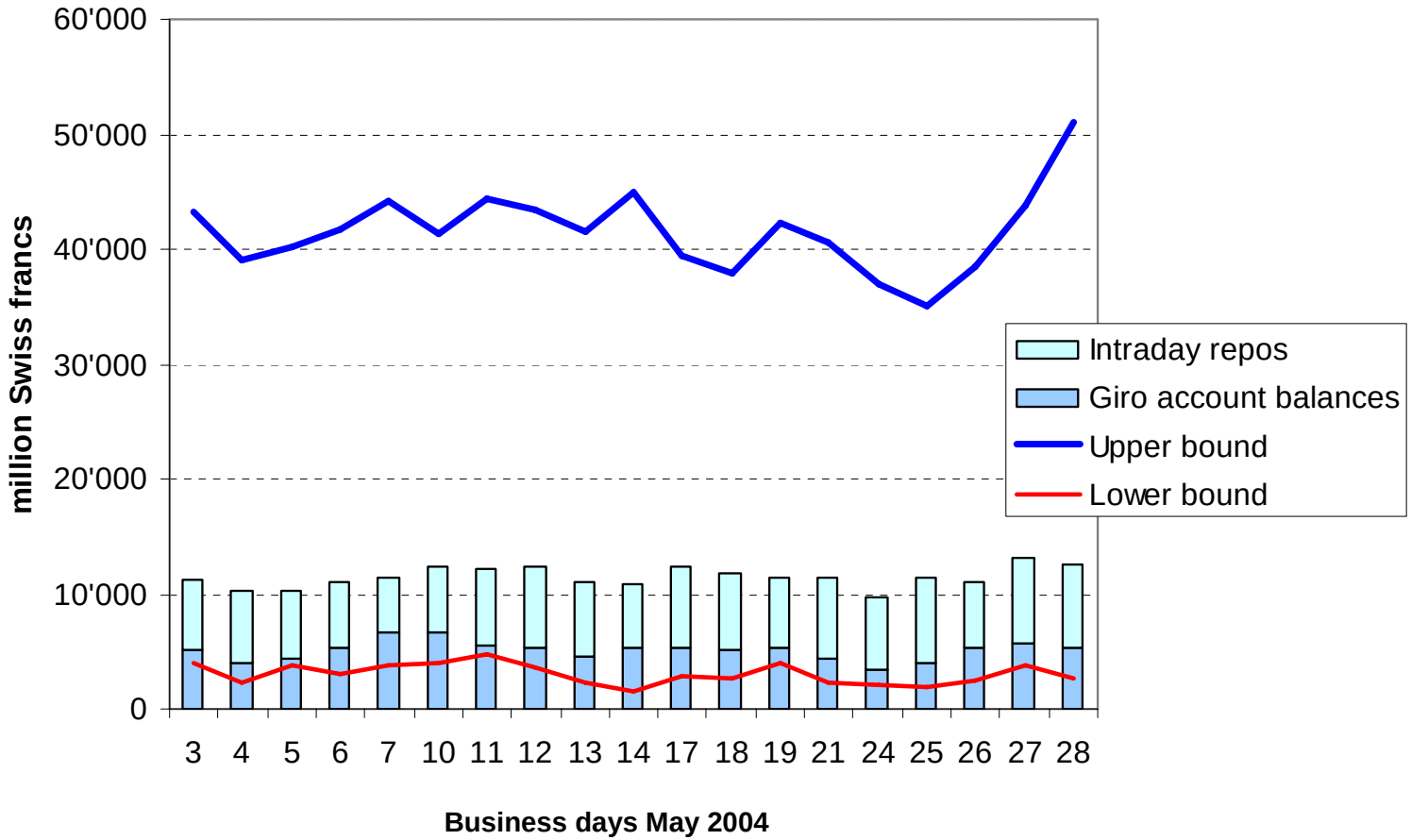
Member structure in SIC

Two large members with more than 50% of values (SNB payments excluded)



Effective liquidity and liquidity bounds in SIC

Average value settled per day in May 2004: CHF 166 bn



Comparison of liquidity levels

Country	Payment system	Simulation period	Lower bound to value settled	Upper bound to value settled	Effective liquidity to value settled (liquidity ratio)	Effective liquidity to upper bound	Reference
Switzerland	***SIC***	***May 2004***	***2%***	***25%***	***7%***	***28%***	**na.**
Denmark	DN Inquiry and Transfer System	4th quarter 1999	11%	37%	–	–	BECH/SORAMÄKI (2005a)
Finland	BoF-RTGS	Last 100 days in 2000	4%	27%	–	–	BECH/SORAMÄKI (2005a)
Norway	NICS	10 days in October 2005	5%	27%	70%	259%	ENGERT/OVERLI (2006)
Sweden	RIX	First half 2004	–	24%	20%	83%	SVERIGES RIKSBANK (2003)
UK	CHAPS Sterling	February 2004	–	–	–	Approx. 150%	BEDFORD/MILLARD/YANG (2004)

→ **SIC settles with relatively low liquidity levels**

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Assumptions for simulations with BoF-PSS2

Operational disruption of a large SIC member:

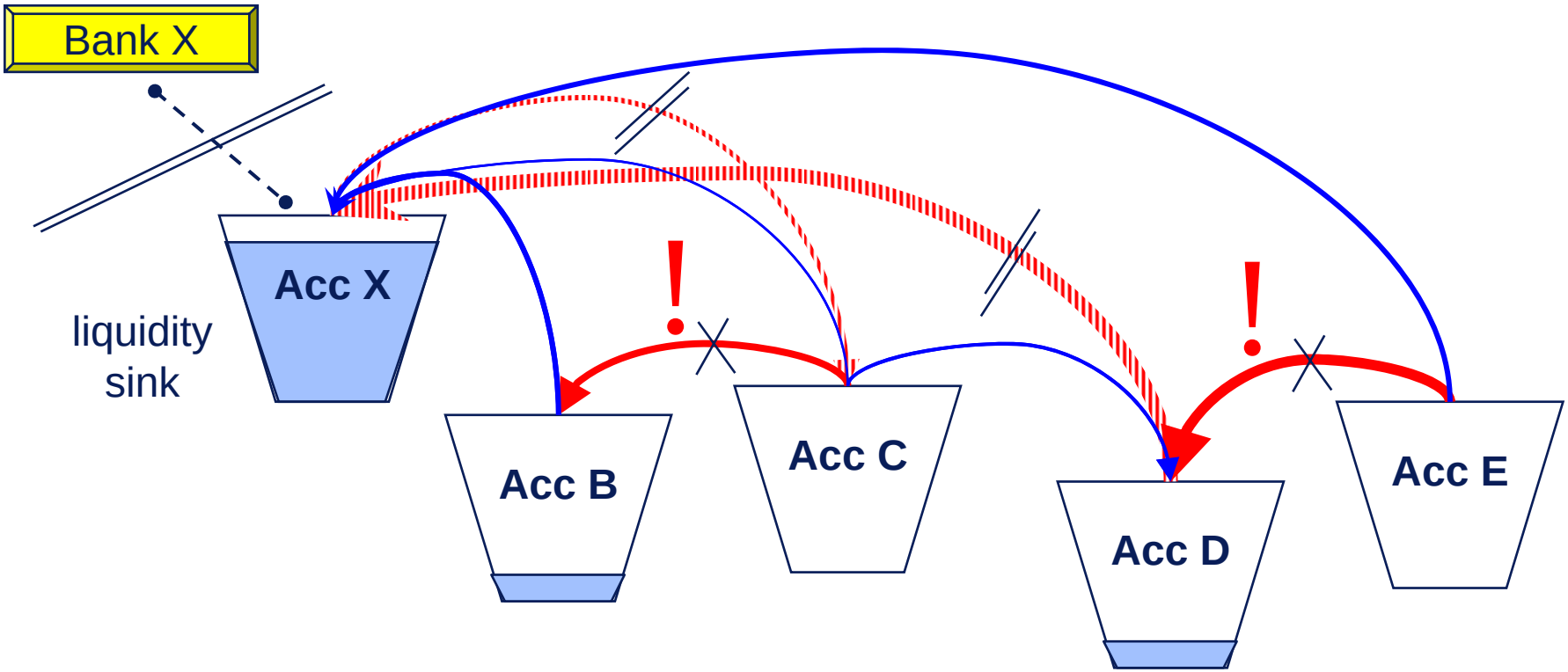
- → SIC member is assumed to fail at the moment when the largest potential liquidity sink develops during the day
- → After disruption, the SIC member can not enter payments during the rest of the day
- → But payments already entered by the disrupted member (queued payments) are settled if liquidity is available
- → Other members stop making payments to disrupted member ***only 2 hours*** after the disruption

Illustration systemic effect

Correctly settled payments

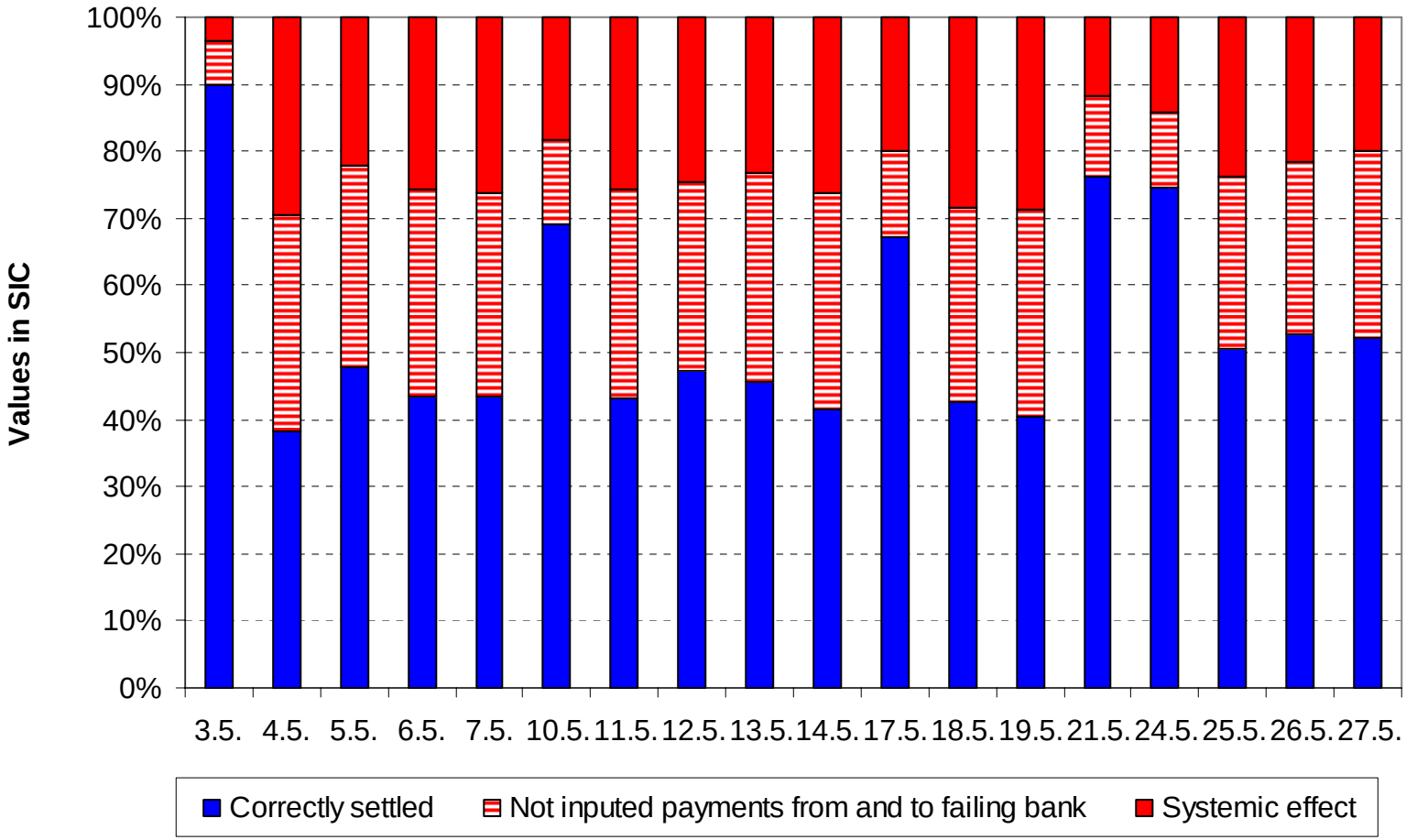
Not inputed payments from and to Bank X

Systemic effect !



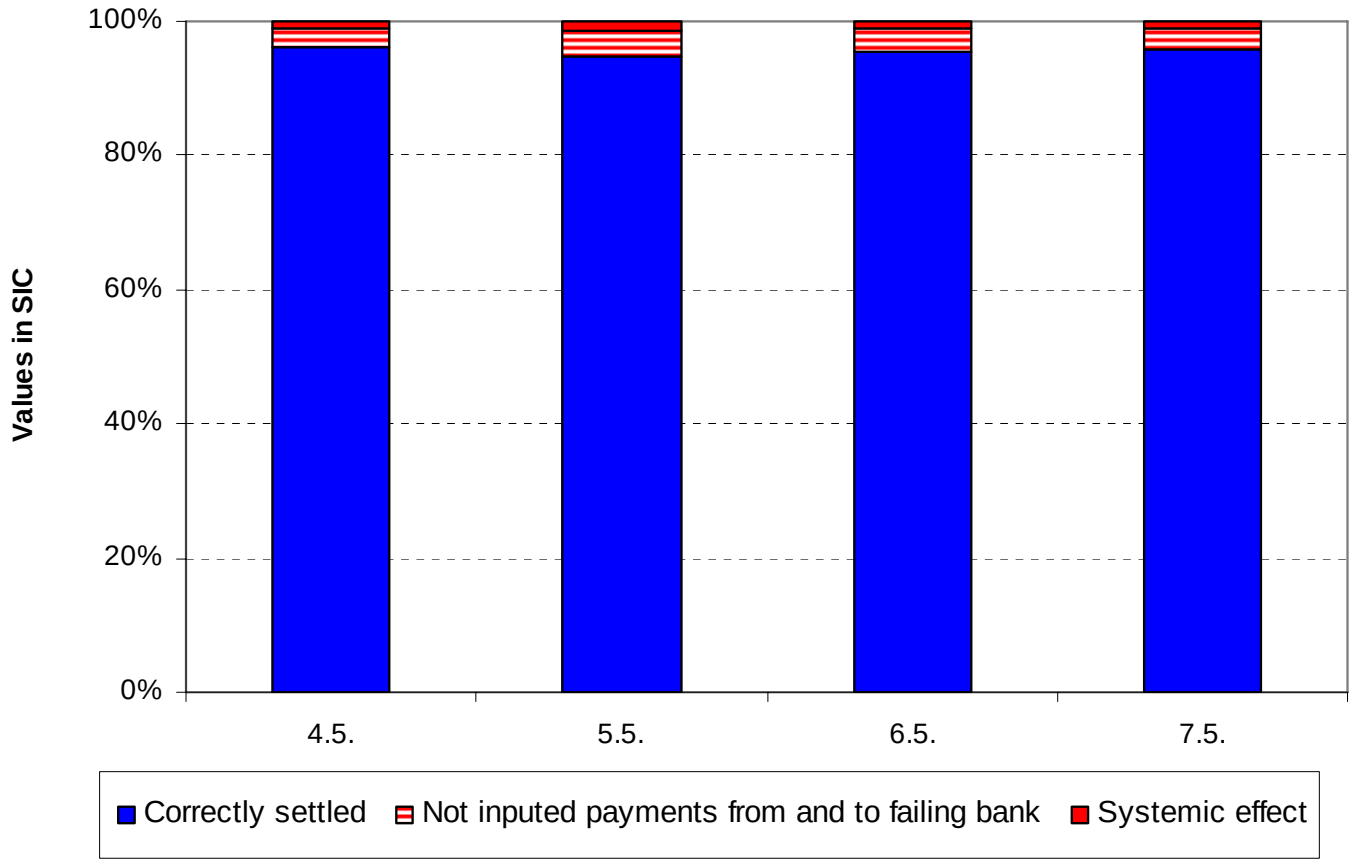
Implications of participant disruption

Average effect of two largest SIC participants, May 2004



Implications disruption of a smaller participant

Effect of participant with large number of payments but lower values, May 2004



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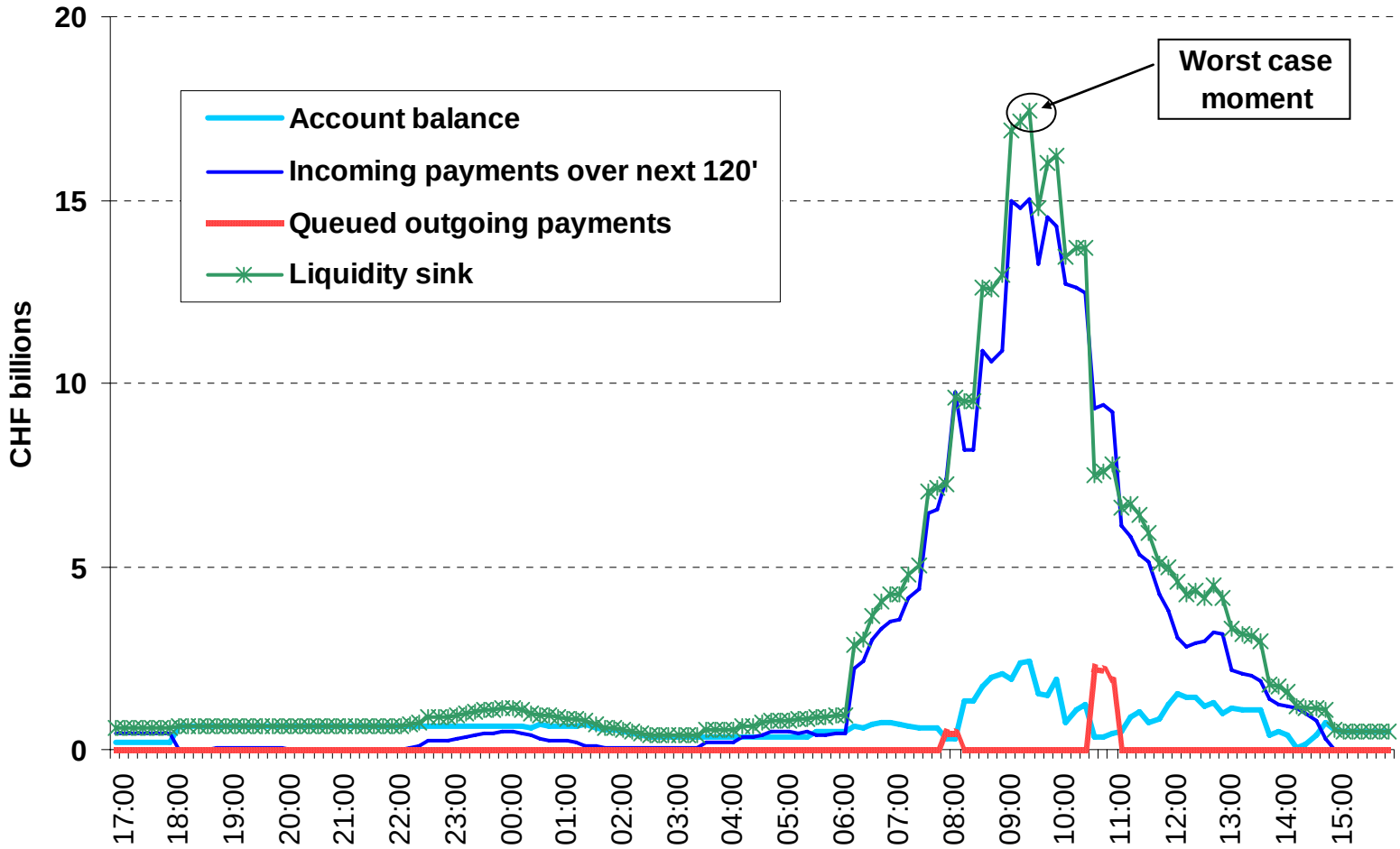
Factors driving size of systemic effect

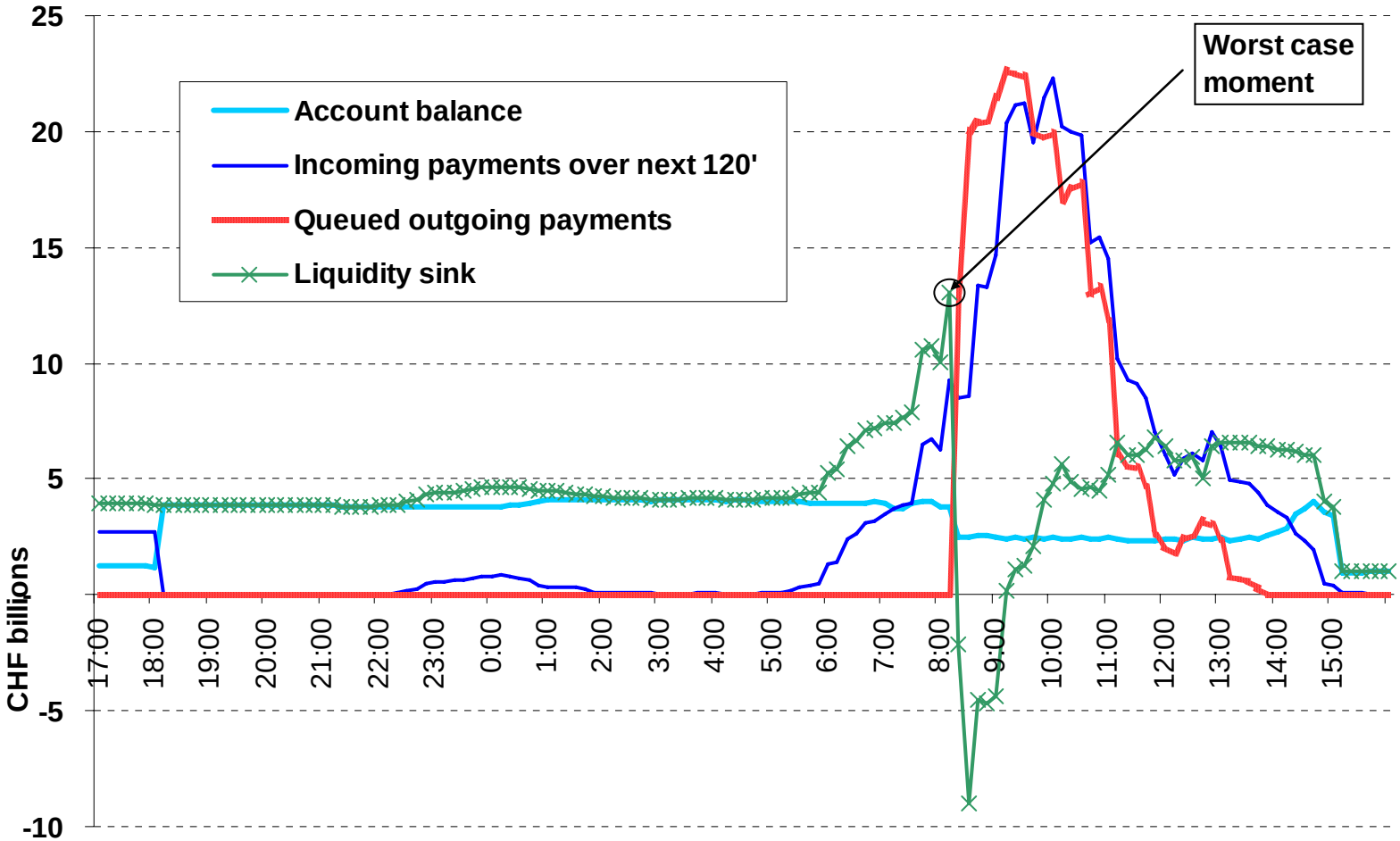
- Factors stemming from the system
  - Member structure
  - Liquidity levels in the system
  - Payment system design
- Random factors
  - Timing of disruption
    (simulation assumption)
- Behaviour of participants
  - Reaction time of non-disrupted members
    (simulation assumption 120‘)
  - Input behaviour

Input behaviour of banks: Queue management (A)



Staggered payment input (internal queue management) creates larger liquidity sink

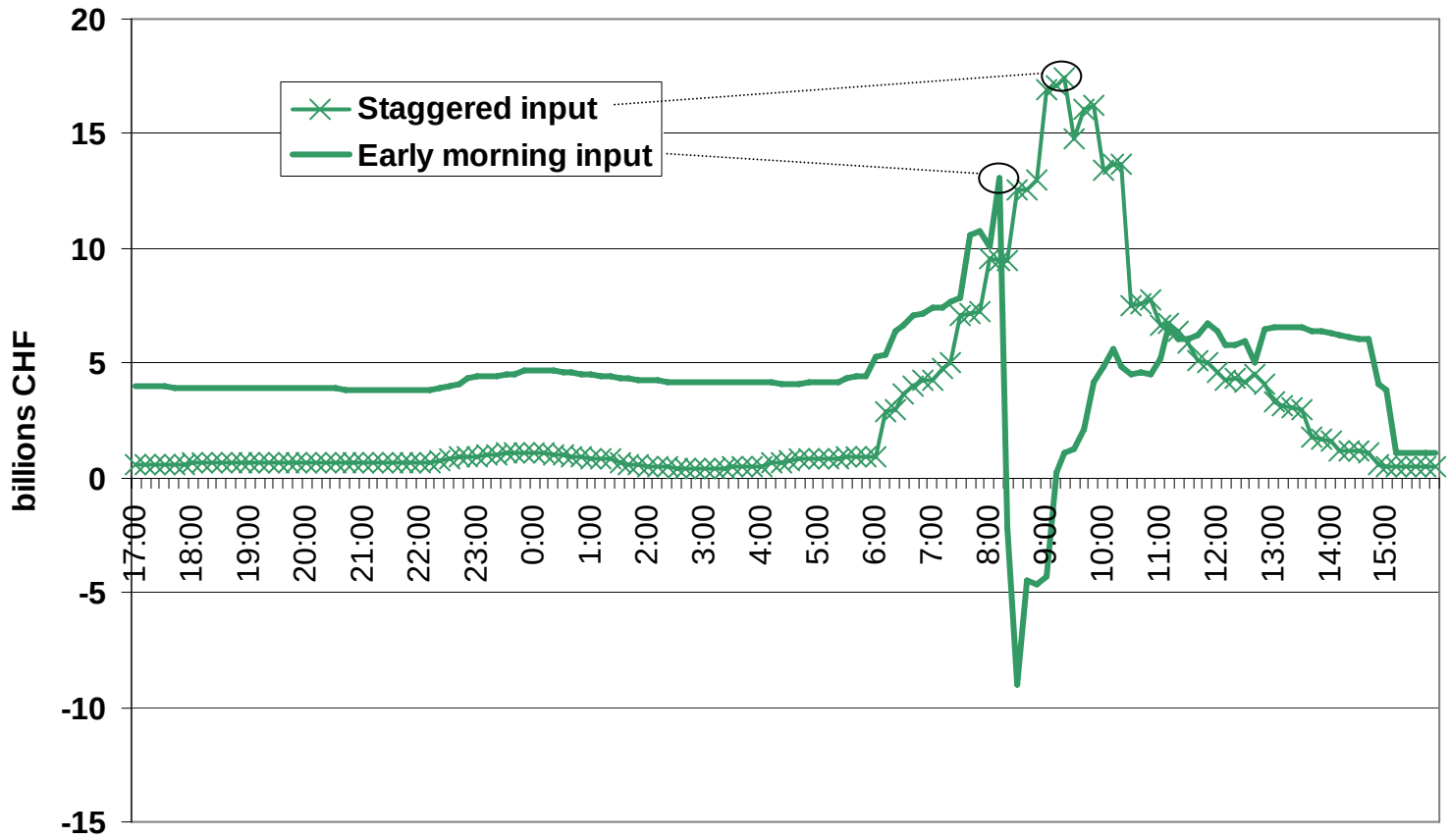
Input behaviour of banks: Queue management (B)



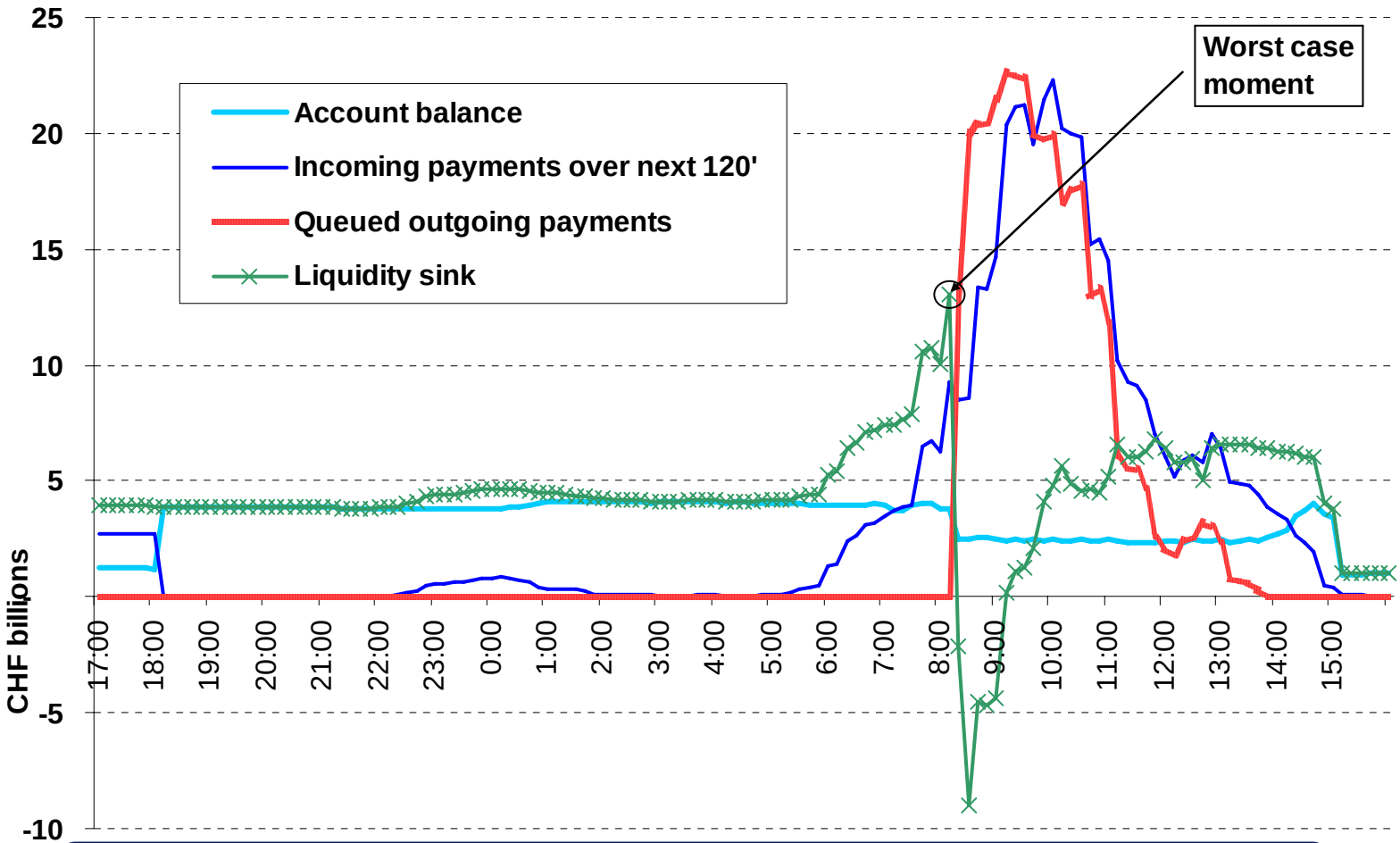
Early morning input of large portion of payment into centralized queue reduces liquidity sink compared to staggered input

Input behaviour of banks: Queue management (C)

Queue management influences size of theoretical liquidity sink

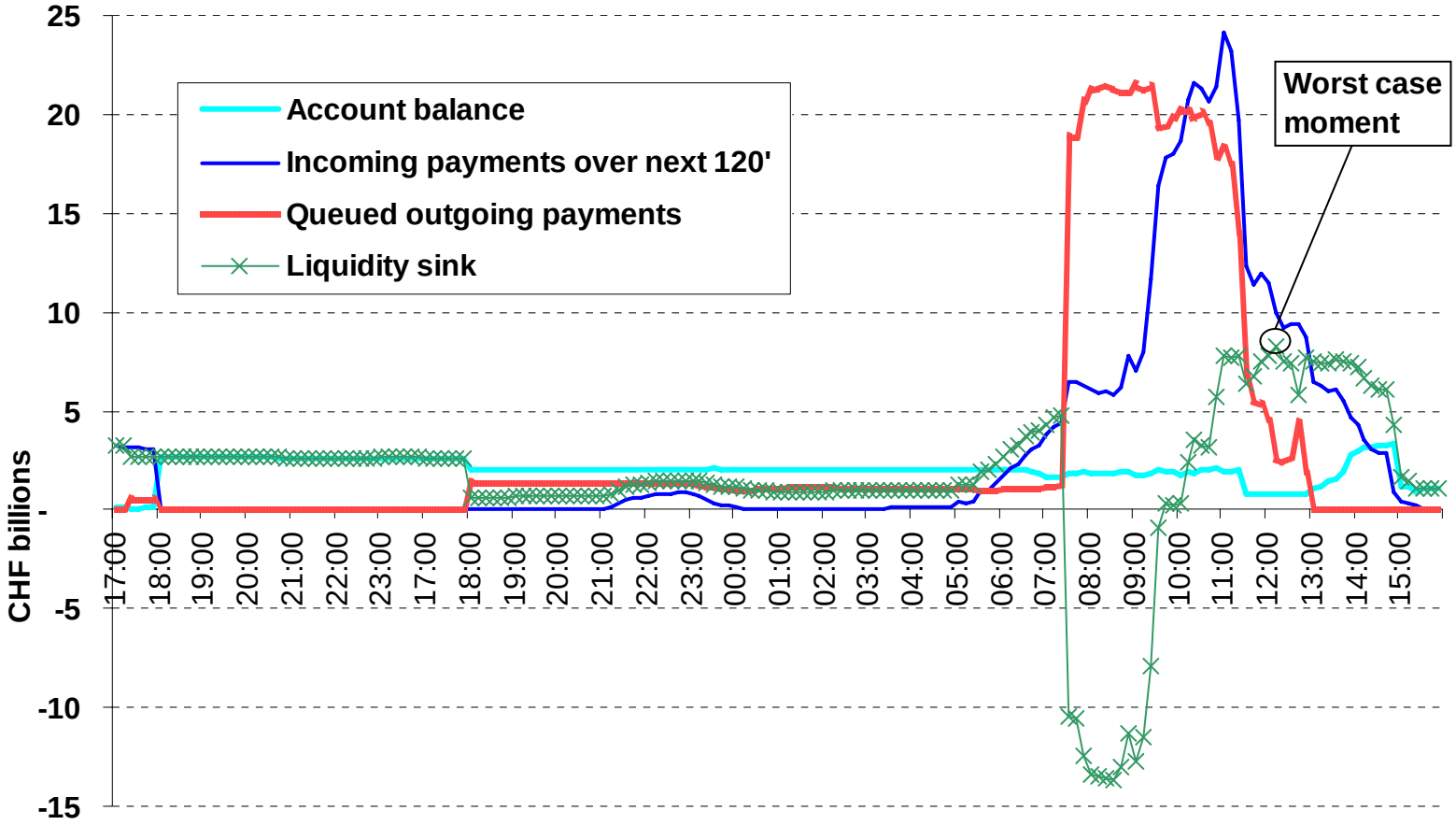


Input behaviour of banks: Timing of input (A)



Input of high-value payments after 8am leads to larger potential liquidity sink and earlier worst case time

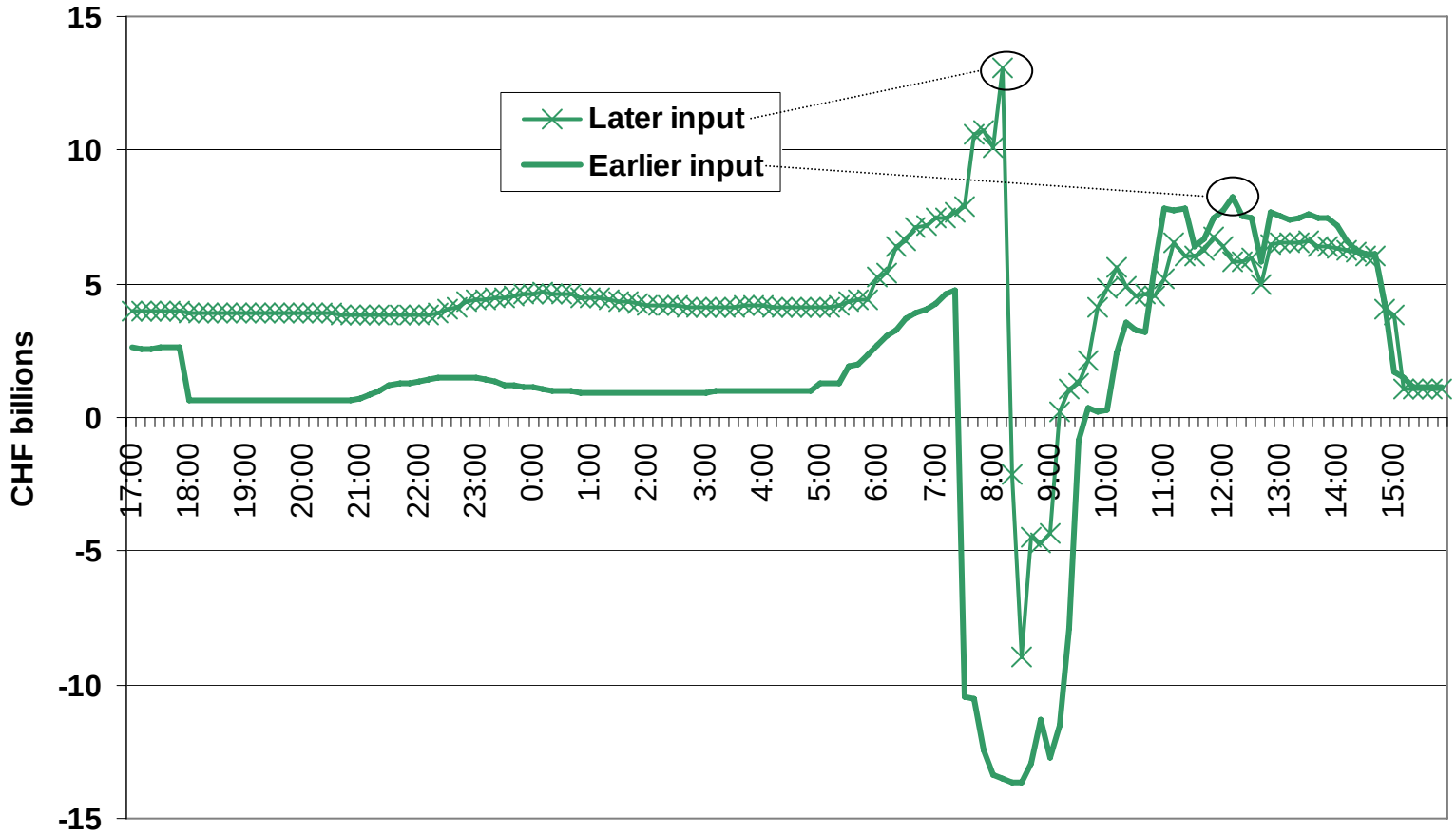
Input behaviour of banks: Timing of input (B)



Earlier input (before 7.30am) of high value payments into the queue leads to lower potential liquidity sink and delays the worst case time

Input behaviour of banks: Timing of input (C)

Timing of input influences size of theoretical liquidity sink



Size of theoretical liquidity sink and systemic effect

(averages May 2004)

	Theoretical liquidity sink		Systemic effect
	% of system turnover	% of effective liquidity in SIC	% of total payments value
Different large participants			
Early input	7 %	106 %	16 %
Staggered input	10 %	151 %	29 %
Same large participant			
Early input	5 %	77 %	3 %
30’ later input	8 %	116 %	21 %

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Measures taken by SNB to contain systemic risk

- **Preventive measures (Requirements)**
  - Maximum downtime of system 2hrs
  - Maximum downtime of critical members: 4hrs
  - Redundant data centres and communication networks
  - Incentives for early inputs and early settlement (progressive fee structure)

- **Reactive measures**
  - Option to postpone clearing stop
  - Access to intraday liquidity, wide range of collateral accepted
  - Possibility for SNB to initiate on-behalf-payments
  - Interbank alarm and crisis organisation to co-ordinate industry reaction
  - Backup procedures for physical data input (tapes)

Potential additional measures to contain systemic risk

- Influence input behaviour of critical members
- Limiting liquidity sink through bilateral or multilateral sender limits
- Introduce optimisation mechanisms (ongoing bilateral or multilateral offsetting)
- Enhancement of existing interbank alarm and crisis organisations including network carriers

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Conclusions

- Vulnerability of a very liquidity-efficient system
- Importance of measures already taken by the Swiss National Bank
  - to prevent operational failures
  - incentive for early payment order input with progressive fee structure
  - to limit the systemic effect with provision of intraday liquidity, on behalf payments, interbank alarm and crisis organization
- Crucial role of the input behaviour of major participants

  → possibility to mitigate systemic effects by adjusting the input behaviour of major participants

- Next step:

  → Analyse optimal member input behaviour:
  - of a single member with all other members‘ behaviour given
  - of multiple members

The End