Liquidity Needs and Settlement Algorithms in the Swiss Interbank Clearing System

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9th Payment and Settlement System Seminar and Workshop

Helsinki, 25-26 August 2011

Agenda

1) Swiss Interbank Clearing (SIC)

2) Liquidity Needs in the SIC System (Banking Operations Analysis Group)

3) Alternative Settlement Algorithms in the SIC System (Oversight Department)

Swiss Interbank Clearing (SIC)

- Settles all large-value payments and large number of retail payments.
- Core of the Swiss financial market infrastructure.
- Operated by SIX Interbank Clearing AG on behalf of SNB.
- SNB provides intraday liquidity through repo facility (Eurex).
- RTGS system with central queues (FIFO).

Studying Liquidity Needs: Starting Point

- Incentives for lower liquidity usage in the SIC system.

→ Lower BoD balances (and altered input behavior) of SIC participants.

- Negative impact on settlement?
- Alternative algorithms to mitigate adverse effects?

Data Sample

- Detailed data set of SIC transactions.
- Days with average/highest/lowest turnover in 2011 (Jan-Apr).
- Transactions with values < CHF 500 not taken into account → Data set reduced by 50% (covering 99.99% of total value).

Performance Figures

- Share of transactions/value settled until the end of the day (effectivity).
- “Delay Indicator” (efficiency).
  - Low: Few queued transactions, little liquidity needed to settle given volume.
  - High: Many large-value payments remain in the waiting queue until the end of the day.

Control Scenario (CS)

- Simulation of an RTGS system with central queues (“Priority and FIFO”).
- Closest approximation of SIC algorithm.

→ How adequate is this replication?

- Almost 100% of all transactions settled (99.58% of total value).
- Very low “Delay Indicator” at 0.05.
- Reference values for further simulations.

Baseline Scenario (BS)

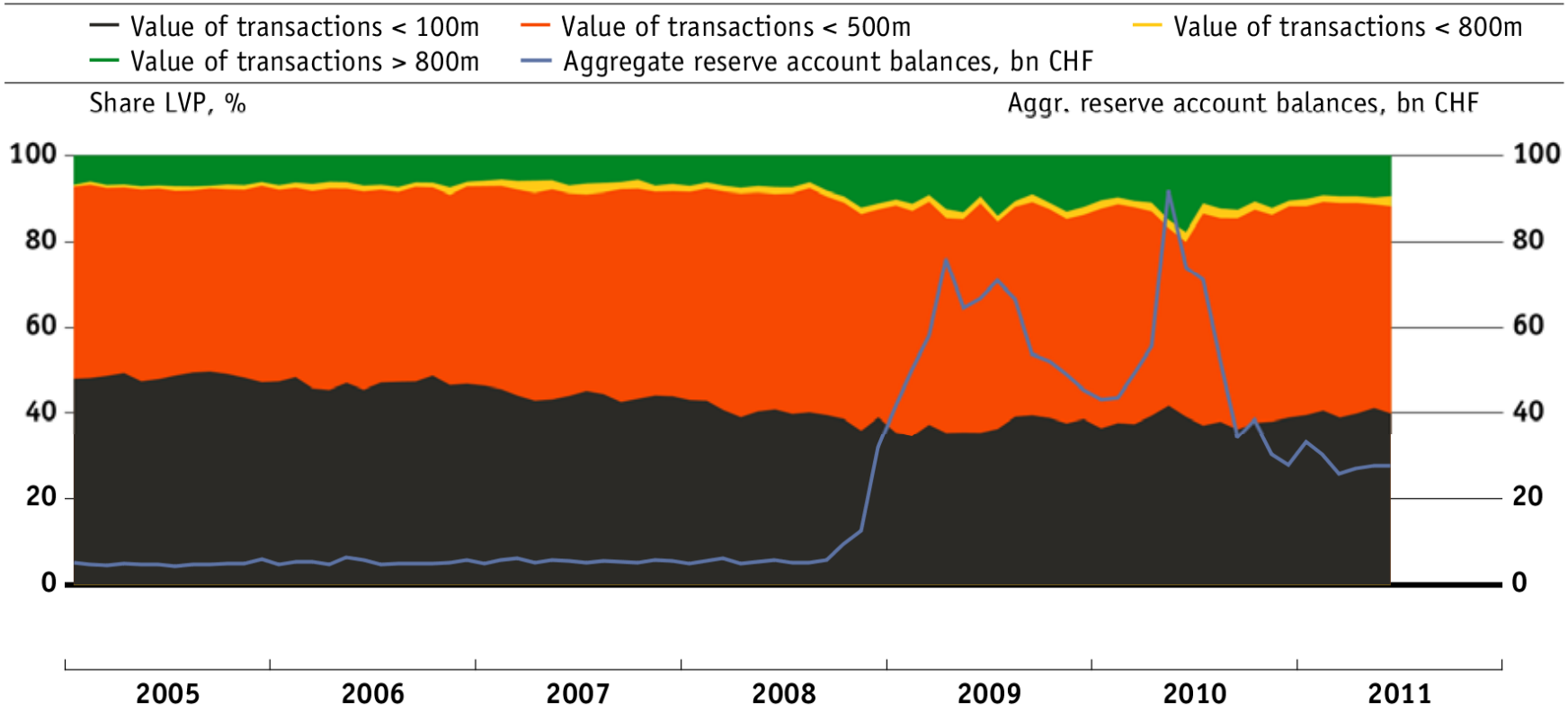
- Same simulation set-up as in CS, but lower BoD balances.
  - Reduction of individual balances to pre-crisis level (yearly average Oct.‘07-Sep.’08).

→ How does this affect settlement success?

  - 99.78% of all transactions settled (97.32% of total value).
  - “Delay Indicator” at 0.12.
  - More large-value payments remain in the waiting queue.

A Case for Splitting…

Share of large-value payments relative to total SIC turnover



BS plus Splitting

- Same set-up as in BS, but consistent splitting of transactions > CHF 100m.

→ Improves effectivity substantially.

  – 98.05% of total value settled.

  – Marginally lower “Delay Indicator” at 0.11.

BS plus Bilateral Offsetting

- Same set-up as in BS, but continuous bilateral offsetting of waiting queues.

→ No substantial effect on effectivity.

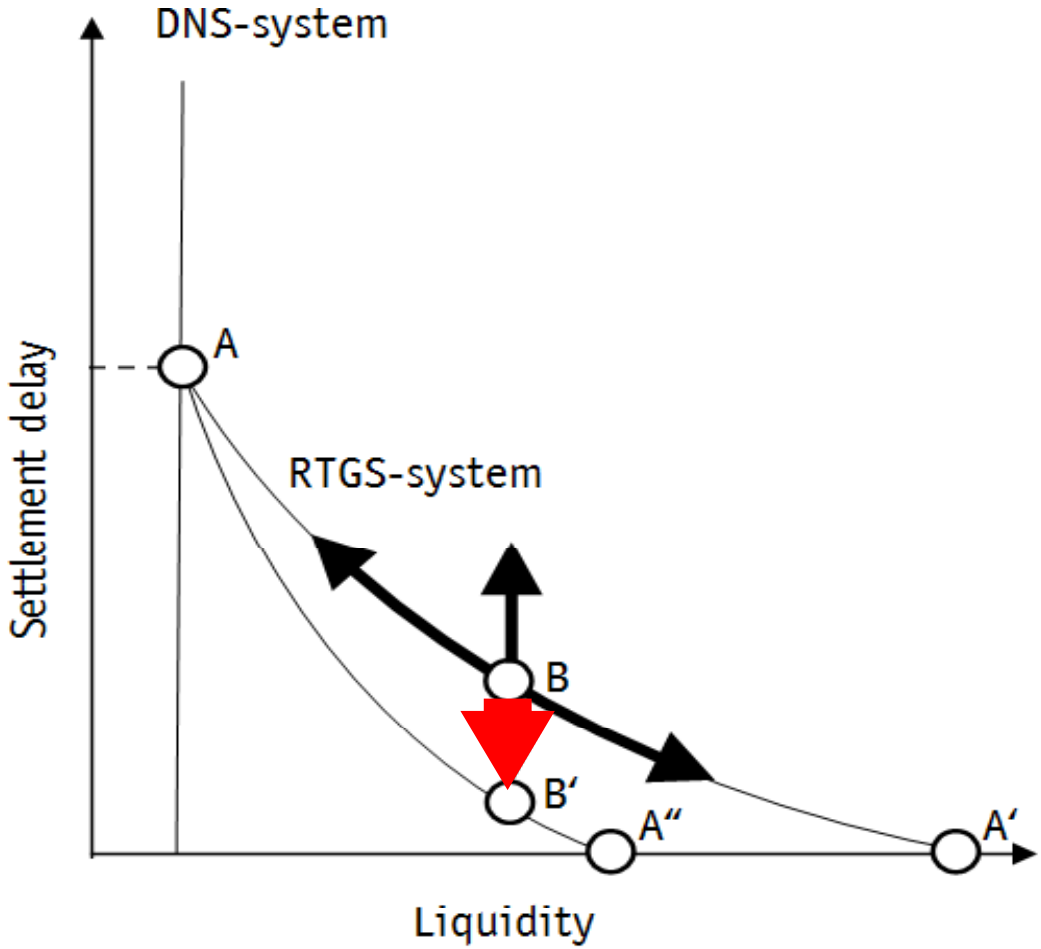
  – But higher efficiency (“Delay Indicator” at 0.09).

- Additional multilateral offsetting does not lead to any improvement.

Conclusion

- Reduction of BoD balances to pre-crisis level leads to lower settlement success.
- However, this is mostly due to lacking motivation to split large-value payments.
- Consistent splitting of transactions > 100m would improve effectivity substantially.
- Alternative algorithms help to settle transactions in the queue more quickly.

Studying Settlement Algorithms: Theoretical Framework



Source: Leinonen and Soramäki (2005), adapted

Data and Simulation Method

- SIC transaction data from February 2007 (pre-crisis) covering 15 payment days.
- Average daily number of 1.2m transactions and an average daily value of 190bn Swiss francs.
- The basic SIC algorithm was compared to four different sets of alternative algorithms.

Measuring Liquidity and Delay

$$Settlement\ Delay = \frac{\sum_i^N \sum_k^K q_{i,k} \times a_{i,k}}{\sum_i^N \sum_k^K p_{i,k} \times a_{i,k}}$$

$$Av.Liquidity\ Ratio = \frac{Intraday\ Liquidity + EoD\ Reserves}{Turnover}$$

Alternative Settlement Algorithms

Number and label	Basic settlement algorithm	Additional optimisation routine
1. Priority and FIFO	Payments are queued when liquidity is insufficient. Payments are released in priority and FIFO order as liquidity becomes available.	-
2. (1.) + Bilateral offsetting	Same basic settlement algorithm as "Priority and FIFO".	Continuous bilateral offsetting is applied that can bypass strict system level priority FIFO order transactions.
3. (1.)+(2.)+ Full multilateral netting every 60 minutes	Same basic settlement algorithm as "Priority and FIFO".	In addition to continuous bilateral offsetting, complete multilateral netting takes place every 60 minutes.
4. (1.) + Splitting of transactions greater than CHF 100 million	Same basic settlement algorithm as "Priority and FIFO".	Transactions that are larger than CHF 100 million are split.

Simulation Results

	Available Liquidity	Settlement Delay				
		Delay SIC	1 Delay Priorities and FIFO	2 (1) + Bilateral Offsetting	(1) + (2) + Full Multilat. Netting	4 (1) + Splitting of Payments
Average	**0.065**	**0.155**	**0.153 (- 1%)**	**0.135 (- 13%)**	**0.135 (- 13%)**	**0.151 (- 3%)**

Conclusion

- In times of scarce liquidity transactions are usually split (behavioral change).

→ The introduction of consistent splitting doesn’t help to improve settlement success.

- Bilateral offsetting has a positive effect on settlement of queued payments.