16th Payment and Settlement System Simulation Seminar
Bank of Finland

The implications of instant payments for RTGS systems

TARGET Analytics Sub-Group

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Outline

Instant payments

Electronic retail payment solutions available 24/7/365 and resulting in the immediate or close-to-immediate interbank clearing of the transaction and crediting of the payee's account with confirmation to the payer (...) irrespective of the underlying payment instrument used (...) and of the underlying arrangements for clearing (...). (ERPB)

- Among the **driving factors** are technological innovation, the reduction in technology costs and the rise of the digital economy.
- **Characteristics** encompass continuous availability, processing speed, immediacy of fund delivery, convenience, ubiquity, flexibility, safety and finality.

Initiatives in Europe

- The ERPB mandated the EPC to develop the **SCT Inst scheme** for pan-European instant payments, which entered into force on 21 November 2017.
- To support the adoption of the scheme and to provide a safe and efficient FMI that can process euro-denominated pan-European instant payments, the Eurosystem:
  1. Introduced in November 2017 a new settlement procedure in TARGET2, **ASI6 Real Time**, for the settlement of SCT Inst compliant transactions via ACHs backed by CeBM
  2. Will launch in November 2018 a new SCT Inst compliant settlement service, **TIPS**, to allow banks to settle instant payments in CeBM

The migration to instant settlement

- Instant payments are typically retail payments, which have traditionally taken place via:
  1. Cash
  2. Retail Payment Systems (RPS)
  3. TARGET2
- A fraction of payments might migrate from each channel to instant settlement and the volume will likely affect banks' liquidity needs.
- Banks' liquidity management will also be affected by the overall level of liquidity in the system.

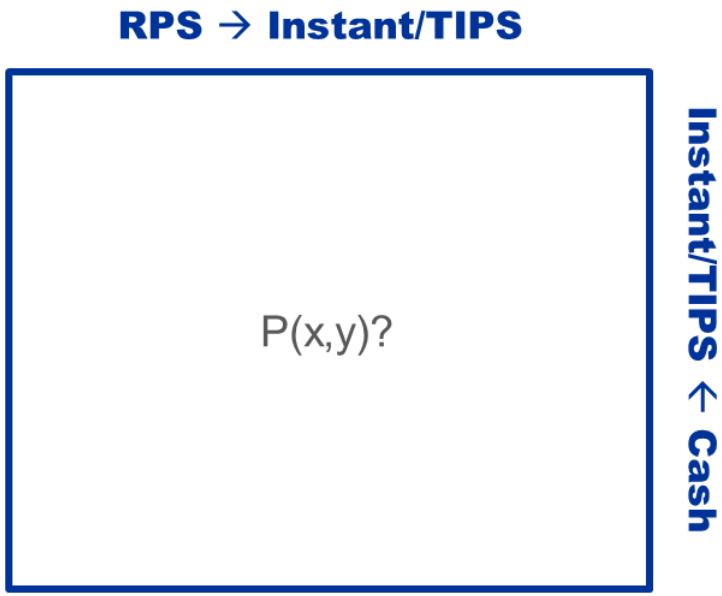
Shifts and trade-offs

The demand for instant payment settlement services is still largely unrevealed and involves shifts and trade-offs:

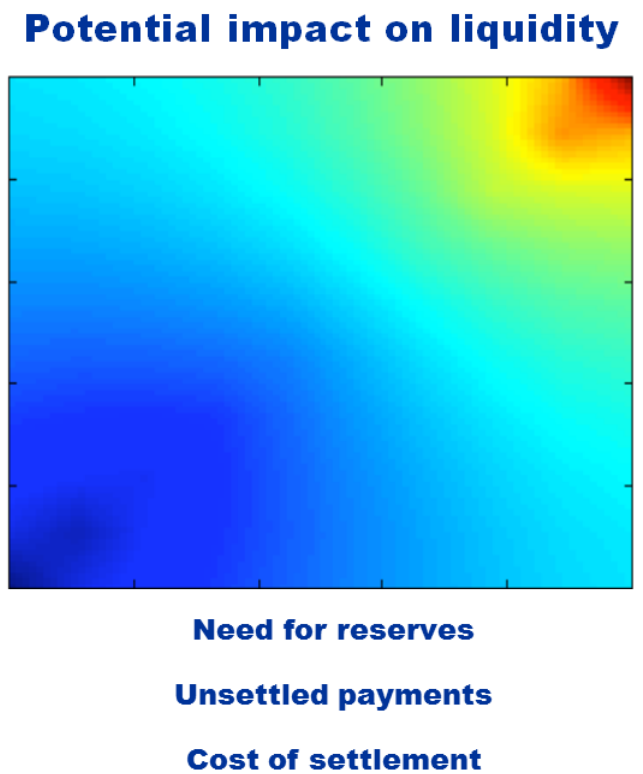
1. From cash to instant settlement
   - The shift from cash to instant settlement is more reserve intensive for banks and potentially involves changes in consumer behaviour.
2. From net to gross settlement
   - RPSs are typically Deferred Net Settlement (DNS) systems, which are less liquidity intensive compared to a gross settlement system, but entail other types of risks.
3. From an RTGS system with LSM to a plain RTGS system
   - Liquidity optimisation algorithms and features reduce the liquidity burden for participants, but come at higher costs.

Mapping scenarios with outcomes

1 Define plausible scenarios



2 Assess the impact of each scenario



Scope of the work

- Estimating the impact of instant payments on liquidity is a complex problem due to the several factors affecting the demand for such payments.
- The problem can be explored by **simulating** the implications of instant settlement on liquidity in an RTGS system using the T2 Simulator.
- The impact of the settlement of instant payments migrating from different channels and at different overall liquidity conditions can be simulated by altering:
  1. The transaction value limit
  2. The traffic volume
  3. The start-of-day balances of participants

System design

- RTGS systems process transactions one-by-one in a real-time environment.
- Two RTGS systems are designed:
  1. With liquidity optimisation algorithms
     - Submission, entry, settlement and end-of-day algorithms
     - Payments can be queued, netted and offset
  2. With no liquidity optimisation algorithms
     - Submission, entry and end-of-day algorithms
     - If the participant to be debited does not have enough liquidity on its account, the payment is unsettled

Exercise set-up

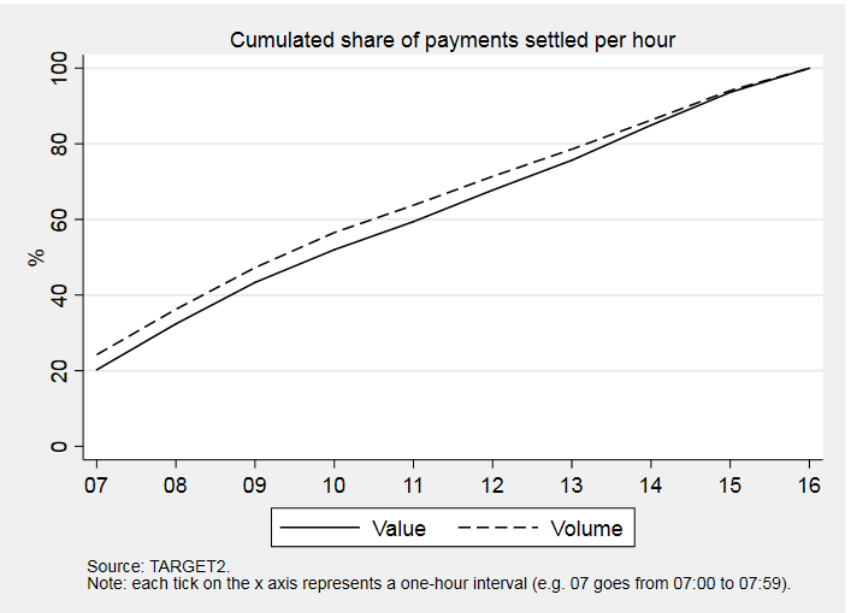
- The subset of TARGET2 payments consisting of *customer payments* is used as input data.
- The assumptions are:
  - No behavioural change occurs on the side of participants
  - The opening hours are the same as in TARGET2
  - The distribution of instant payments over the business day is the same as that of customer payments in TARGET2
- Results are calculated in relative terms, i.e. as the difference between the plain RTGS system and the RTGS system with LSM.

Input data

In the baseline scenario:

- Participants' start-of-day balances in TARGET2
- MT103 and MT103+ messages below €15,000 settled in TARGET2

At daily level	Avg	Min	Max
Value (€million)	427	396	463
Volume (#transactions)	140,212	124,067	163,187
Participants (#BIC11)	717	706	732



Alteration of transaction value limit

Scenario design:

- The SCT Inst scheme indicates €15,000 as transaction limit, but it can be raised upon mutual agreement by PSPs. For other instant payment schemes (e.g. in GB and SG), limits have already been increased.
- The €15,000 threshold is increased first by five times and then by ten times.

Baseline scenario: $P_{d,\,t} \leq €15{,}000$

Scenario A: $P_{d,\,t} \leq €75{,}000$

Scenario B: $P_{d,\,t} \leq €150{,}000$

on day d at time t

Alteration of transaction value limit

Results:

- By increasing the transaction limit, a larger number of customer payments is included in the scenario simulations.
- Traffic increases first by ∼20% in volume terms and ∼260% in value terms, and then by an additional ∼5% and ∼60% respectively.
- Comparing results obtained in a plain RTGS system to those obtained in an RTGS system with LSM:

Scenario	% unsettled payments	Change compared to baseline
Baseline	+10.23%	-
Limit at €75,000	+13.77%	+3.54%
Limit at €150,000	+14.88%	+4.65%

Alteration of traffic volume

Scenario design:

- Small-value payments (below €15,000) may migrate to instant settlement from cash and Retail Payment Systems.
- The number of payments is increased by randomly adding payments whose timing is assumed to be uniformly distributed over the business day.

Baseline scenario: $\textit{total volume}_d = n_d$

Scenario C: $\textit{total volume}_d = a \cdot n_d$

Scenario D: $\textit{total volume}_d = b \cdot n_d$

where n is the number of payments on day d

Alteration of traffic volume

Results:

- Traffic is first randomly doubled and then randomly quadrupled.
- The additional transactions are randomised on their introduction time.
- Comparing results obtained in a plain RTGS system to those obtained in an RTGS system with LSM:

Scenario	% unsettled payments	Change compared to baseline
Baseline	+10.23%	-
Double dataset	+11.29%	+1.06%
Quadruple dataset	+12.07%	+1.84%

Alteration of start-of-day balances

Scenario design:

- Liquidity conditions can be altered to simulate different levels of availability to participants.
- The upper and lower bounds of liquidity are computed and provided to participants as start-of-day balances.

Baseline scenario: $balance_{d,\ sod} = \sum_{i=1}^{I} balance_{i,d,sod}$

Scenario E: $balance_{d,\ sod} = \sum_{i=1}^{I} max(0; balance_{i,d,sod} - min(balance_{i,d}))$

Scenario F: $balance_{d,\ sod} = \sum_{i=1}^{I} max(0; balance_{i,d,sod} - balance_{i,d,eod})$

where i is the number of accounts

Alteration of start-of-day balances

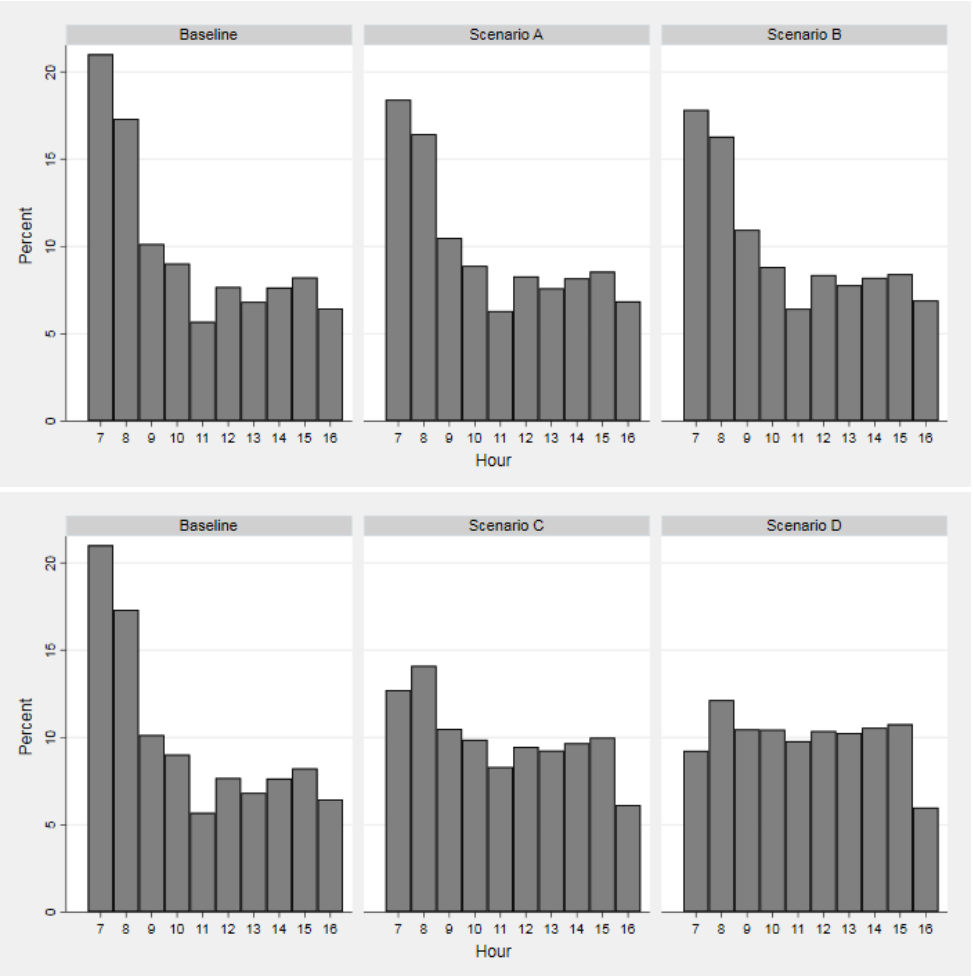
Results:

- Participants are provided first with the liquidity needed to settle all payments at start of day and then with the liquidity needed to settle their end-of-day positions.
- Comparing results obtained in a plain RTGS system to those obtained in an RTGS system with LSM:

Scenario	% unsettled payments	Change compared to baseline
Baseline	+10.23%	-
At upper bound of liquidity	+2.28%	-7.95%
At lower bound of liquidity	+44.66%	+34.43%

- Comparing start-of-day balances at the upper and lower bounds, the minimum additional liquidity banks would need to be able to settle all payments at the start of the day is ∼€29 millions.

Time distribution of unsettled payments



- In the plain RTGS system, the time distribution of unsettled payments is largely unchanged as the transaction value limit is increased.
- When uniformly distributed random transactions are added, the time distribution of unsettled payments becomes flatter.

Summary of findings

- The exercise aims at estimating the impact of instant settlement on different liquidity aspects in a plain RTGS system compared to an RTGS system with LSM.
- Different scenarios are simulated over three dimensions: (i) transaction value limit, (ii) traffic volume and (iii) start-of-day balances.
- Results show that banks' liquidity needs are affected by LSM, as well as by the available liquidity. The extent of the impact depends on the characteristics of the underlying payments.
- Limited to the set of payments considered, the increased liquidity needs appear to be contained.

Conclusion and way forward

- Based on the exercise results, *ceteris paribus*, the impact of real-time settlement in a plain RTGS system depends on the traffic and payment characteristics.
- However, instant settlement is likely to affect both bank behaviour, in terms of liquidity management, and consumer behaviour, in terms of payment choices.
- Areas of future analysis could include:
  1. Simulating a change in participant behaviour by shifting the timing of payments (e.g. early vs late payers)
  2. Extending the business hours to 24/7
  3. Exploring the relative cost of the increased liquidity needs

Thank you!

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