18th Payment and Settlement System Seminar

Bank of Finland

Strengths of LSM in TARGET2

TARGET Analytics Sub-Group

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Outline

- Background and motivation
- Methodology
- Results
- Conclusion

Background

- Liquidity optimisation mechanisms are introduced to reduce the high liquidity needs associated to an RTGS and support the effective liquidity usage by participants.
- TARGET2, the RTGS system owned and operated by the Eurosystem, offers comprehensive optimisation and liquidity management tools:
  - customer-services: liquidity management features (LMF); and
  - in-built instruments: liquidity savings mechanisms (LSM).
- While the TARGET2 operator regularly revises their functioning and usage, limited attempts had been made to quantify the benefits related to the presence of liquidity optimisation mechanisms for the TARGET2 participants.

Liquidity optimisation in TARGET2

LSF

Priorities

Reservations

Limits

Timed payments

Liquidity pooling

Active queue management

LSM

Entry offsetting algorithms

Queues

Queuing resolution and optimisation algorithms

- *All or nothing optimisation (ALGO1)**
- Partial optimisation (ALGO2)
- Multiple optimisation (ALGO3)
- Partial optimisation with AS (ALGO4)
- Optimisation with AS (ALGO5)

*switched off in 2009

- Previous studies covered individual LSF or theoretical models.
- The current study focuses on LSM.

Motivation

- The study assesses the impact of LSM in TARGET2 by estimating how much their presence improves settlement performance.
- Its purpose is to:
  - provide to the TARGET2 operator insights on the functioning and efficiency of settlement in TARGET2;
  - support compliance with the PFMIs and SIPS regulation article 8 on liquidity risk;
  - gain understanding of the effectiveness of LSM, which are designed to facilitate participants' efficient liquidity risk management; and
  - provide some lessons learned for the design of functionalities of the future TARGET services.

Methodology

- Extension of a methodology similar to a previous TAG study “The potential liquidity implications of instant payments for TARGET2” to entire TARGET2 perimeter.
- Using the TARGET2 BoF Simulator, constraints are imposed to the settlement mechanisms of TARGET2.
- Scenarios are created where the liquidity saving mechanisms, in particular offsetting and queue optimization algorithms, are deactivated to recreate a pure RTGS system, and then sequentially reintroduced.
- End of day settlement levels in the altered scenarios are then compared to the results obtained under normal TARGET2 parameters (benchmark simulation).

Methodology

	Description	Basic algorithms	Additional algorithms
Benchmark	**Regular TARGET2 set-up**	All algorithms included	
Scenario 1	Most similar to plain RTGS set-up T2 excluding - bilateral offsetting and multilateral offsetting - partial and multilateral optimisation	T2ENTRY1 T2EVTHND T2SETTL1 ALGO4 ALGO5 ENDRTGS1	
Scenario 2	RTGS + bilateral and multilateral offsetting T2 excluding - partial and multilateral optimisation	T2ENTRY1 T2EVTHND T2SETTL1 ALGO4 ALGO5 ENDRTGS1	T2BOS T2EXTBOS T2EXPRESS
Scenario 3	RTGS + bilateral and multilateral offsetting and partial optimisation T2 excluding - multilateral optimisation	T2ENTRY1 T2EVTHND T2SETTL1 ALGO4 ALGO5 ENDRTGS1	T2BOS T2EXTBOS T2EXPRESS ALGO2
Scenario 4	RTGS + bilateral and multilateral offsetting and multilateral optimisation T2 excluding - partial optimisation	T2ENTRY1 T2EVTHND T2SETTL1 ALGO4 ALGO5 ENDRTGS1	T2BOS T2EXTBOS T2EXPRESS ALGO3

- The analysis covers bilateral and multilateral offsetting and partial and multiple optimization algorithms.
- ALGO4 and ALGO5 had to be excluded as inherent to the settlement of ASI5 and ASI6, i.e. settlement would completely fail without.

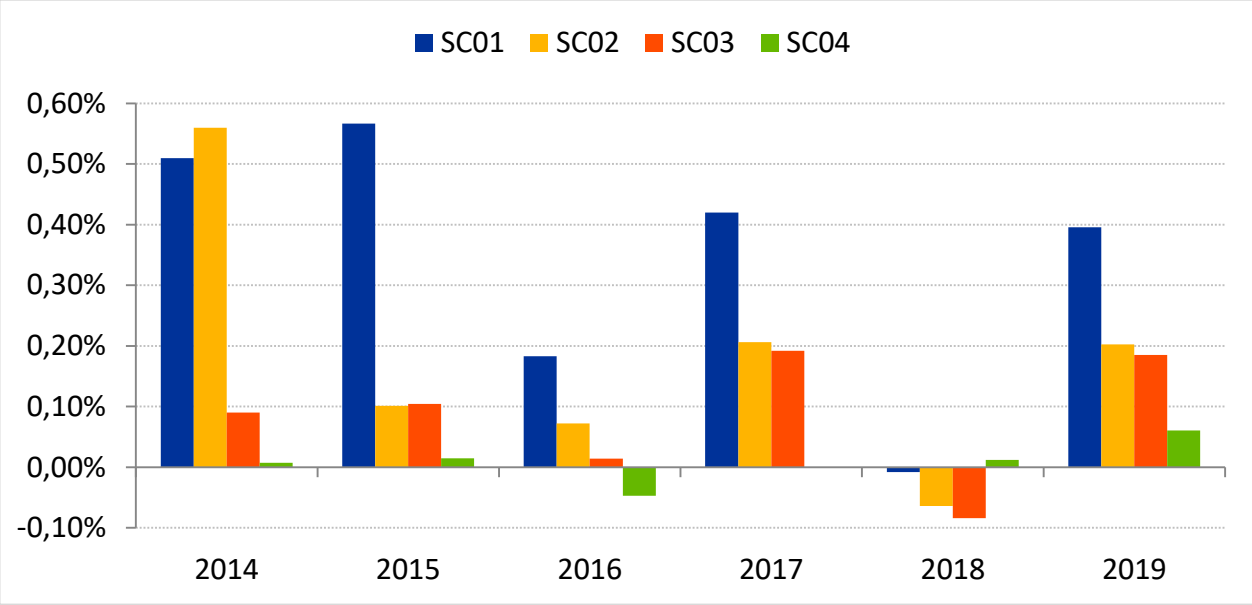
Methodology

- Input data include all traffic settled in TARGET2 to make the results useful also under an operational point of view.
- The analysis covers two weeks over different years to compare the liquidity impact across varying liquidity levels (2014-2019).
- Assumption of no behavioral changes on the side of the participants is taken.
- Failed recourse to overnight deposits is excluded from the simulations output.
- Some transactions unsettled in the benchmark are settled in the scenarios. The effect may depend on technical limitations of the simulator or liquidity availability in the accounts due to changed settlement logics in the scenarios.

Results

Increase in share of unsettled transactions – value

(difference from the benchmark – average)

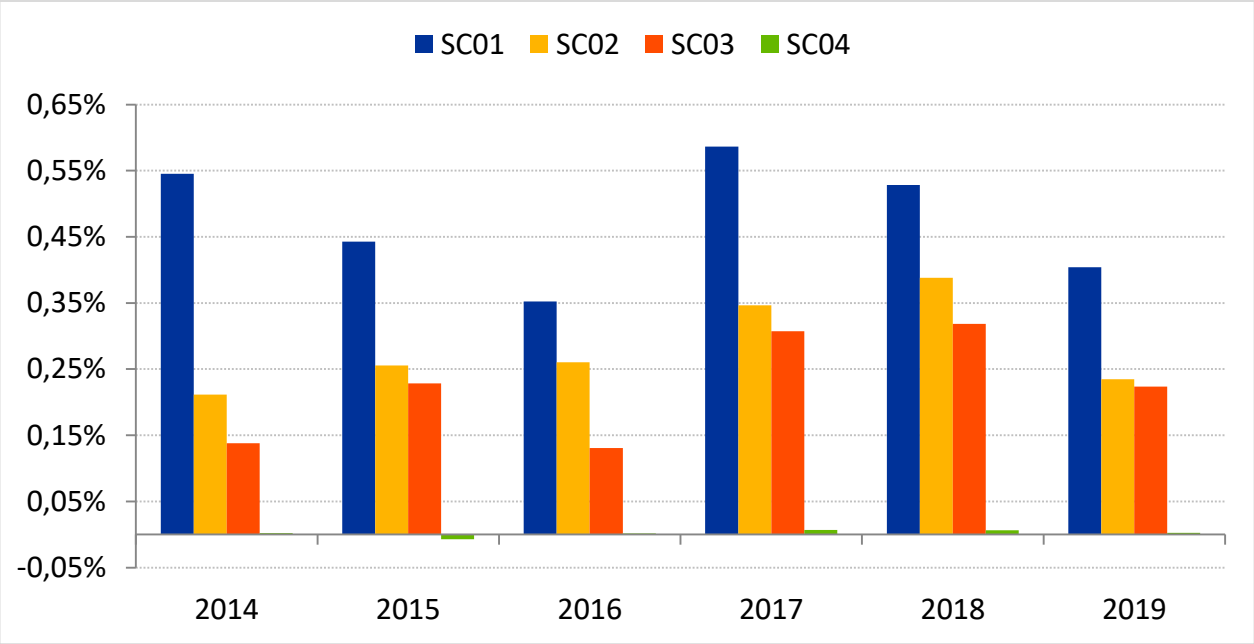


- The exclusion of one or more algorithms mostly deteriorates settlement levels in TARGET2 in value, except for 2018.
- The worst-case (plain RTGS-like scenario) leads almost always to the most severe results: increased unsettled payments range between 0.18% and 0.57% (- 0.01% in 2018) of total value, corresponding to an average of EUR 10.5 billion (EUR 8.7 billion including 2018).

Results

Increase in share of unsettled transactions – volume

(difference from the benchmark – average)

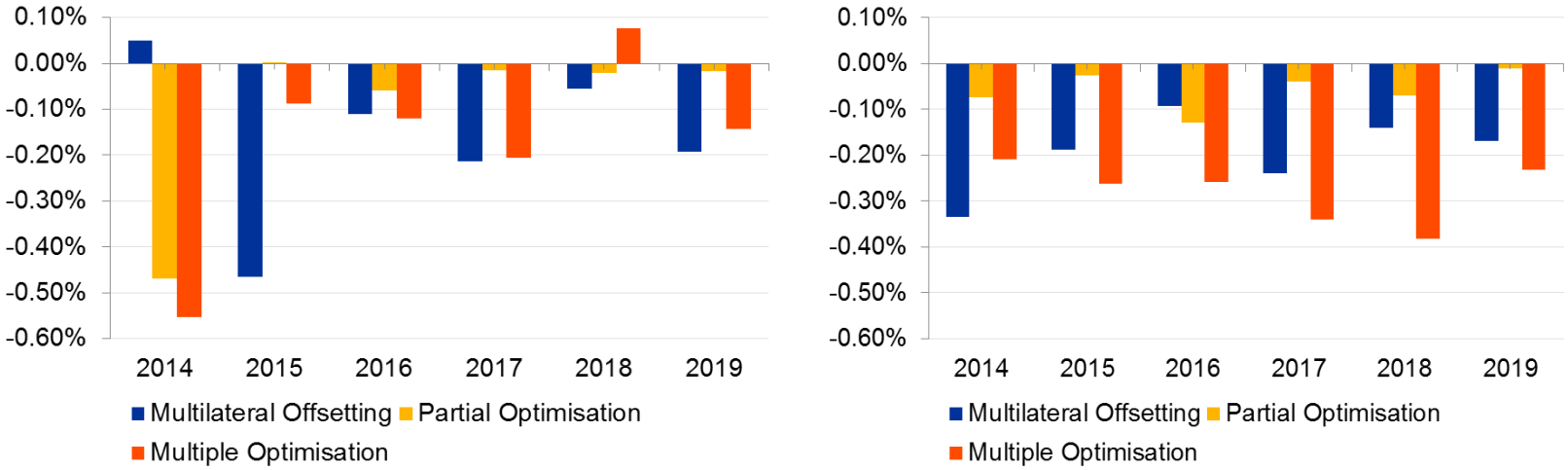


- In volume, the effect of removing algorithm(s) is slightly more pronounced and in line with the severity of the scenarios.
- In the worst-case increased unsettled payments range between 0.35% and 0.59% of total transactions, corresponding to an average of 1,721 transactions.

Results

Impact on unsettled transactions by algorithm

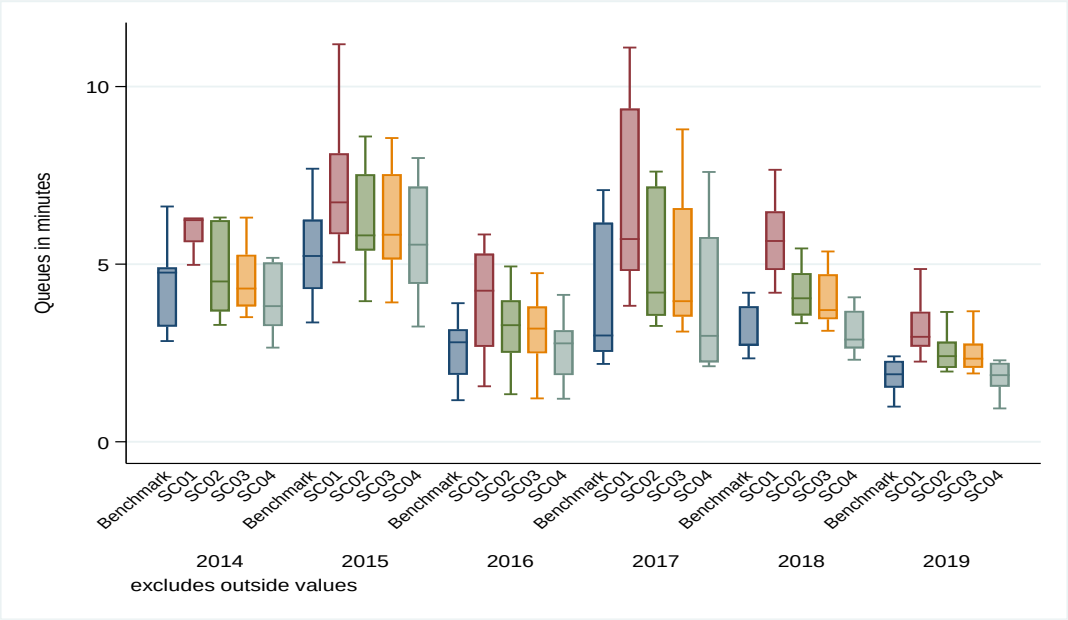
in value (left panel), in volume (right panel)



- Bilateral/multilateral offsetting and multiple optimization are on average more effective than partial optimization in improving settlement. This is in particular the case with respect to the volume of payments.
- Relative improvements from a value perspective decrease over time, as liquidity levels in TARGET2 increase.

Results

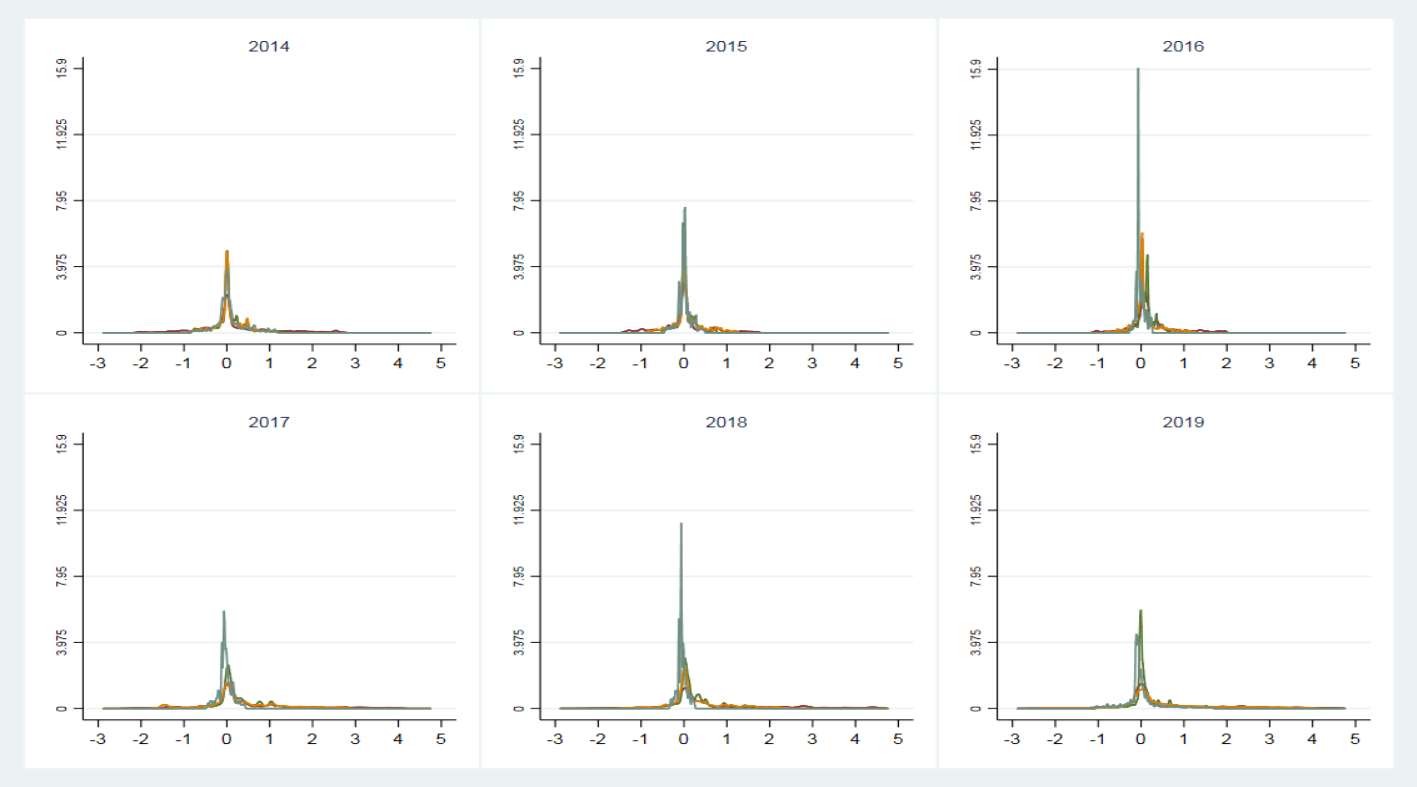
Queuing time, customer and interbank payments



- Queuing time at system level increases in all scenarios, in particular in the pure RTGS scenario. The impact is consistent with the severity of the constraints imposed.
- Improvements are more pronounced when re-introducing offsetting and multilateral optimization.

Results

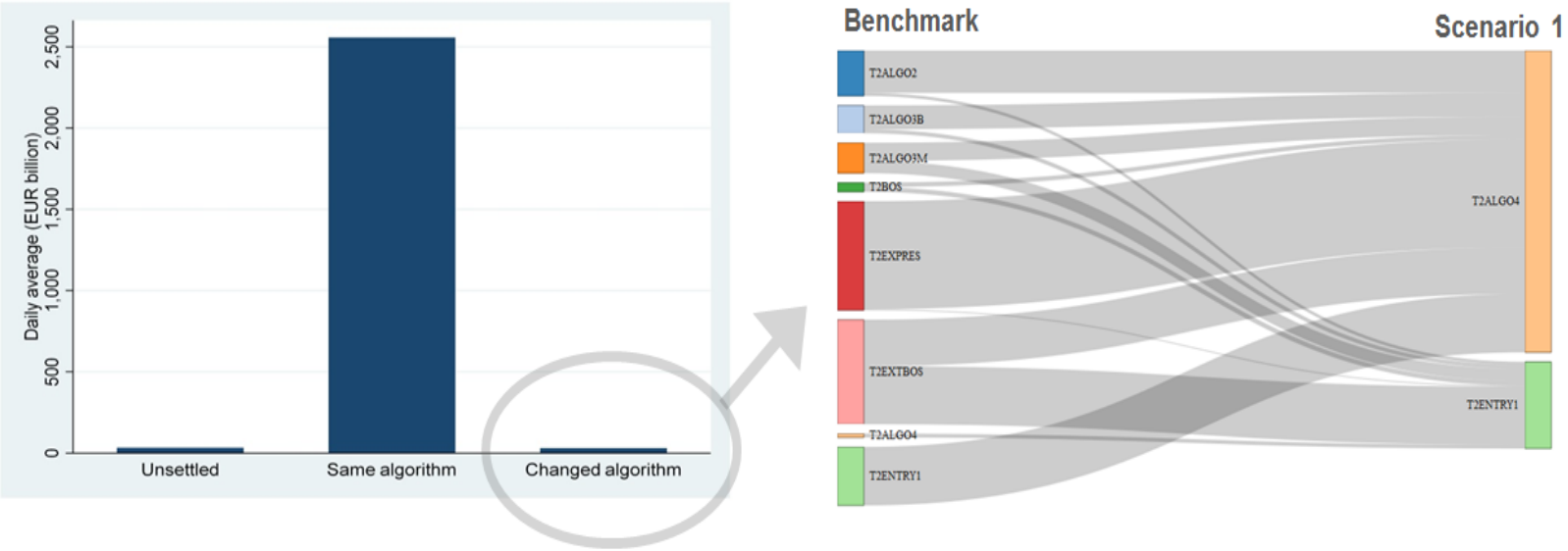
Change in queuing time compared to benchmark for individual transactions,



- Distribution is very centered around a median close to zero, showing that in the scenario queuing time mostly does not change or marginally changes compared to the benchmark.
- It however contains many outside values, in both directions, also as effect of changed settlement status of some transactions.

Results

Usage of algorithms for settled transactions in benchmark and Scenario 1



- Altering LSM some transactions are settled across scenarios using different algorithms, i.e. some algos become more efficient in presence of constraints.
- For example in Scenario 1 in 2019, on a daily basis 2.9% of the overall traffic in value was settled with a different algo compared to the one used in the benchmark. The picture for volume is very similar (2.1%).
- In Scenario 1 the settlement performance of the ENTRY algorithm as well as the partial optimization with AS (ALGO4) improve, both in value and volume terms.
- The lower the constraint, the less transactions are settled with different algos

Conclusions

- The presence of analyzed LSM improves TARGET2 settlement performance.
- Across most years and scenarios, settlement efficiency improves as the configuration becomes closer to the TARGET2 set-up: when LSM are present, the share of unsettled payments tends to decline. The pattern is less consistent for the value, whereas it is for the volume.
- Bilateral/multilateral offsetting and multiple optimization are more effective in improving settlement compared to partial optimization.
- Queuing time improves on average when LSM are re-introduced, and impact is in line with the constraint imposed. The majority of transactions queues only shortly, while few payments queue for many hours.
- Settlement efficiency of remaining algorithms improves in presence of constraints.

Conclusions

- While the impact appears to be quite limited, with additional unsettled payments remaining in a range well below 1%, it should be recalled that:
  - LSM settle only a small share of TARGET2 payments.
  - The algorithms analyzed in this study process only a subset of TARGET2 payments, as all transactions settled by optimization algorithms working with AS transactions had to be excluded.
  - liquidity levels in TARGET2 have been high in the last years, particularly as result of the measures of unconventional monetary policy and the APP.
- Notwithstanding, algorithms prove to be effective in reducing the level of unsettled transactions also in conditions of high excess liquidity.
- Liquidity saving algorithms provide an important buffer against possible future changes of conditions.

Thank you!

References

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Diehl, M., & Schollmeyer, U. (2012). Liquidity-Saving Mechanisms: Quantifying the Benefits in TARGET2.

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TAG study “The potential liquidity implications of instant payments for TARGET2”, January 2019

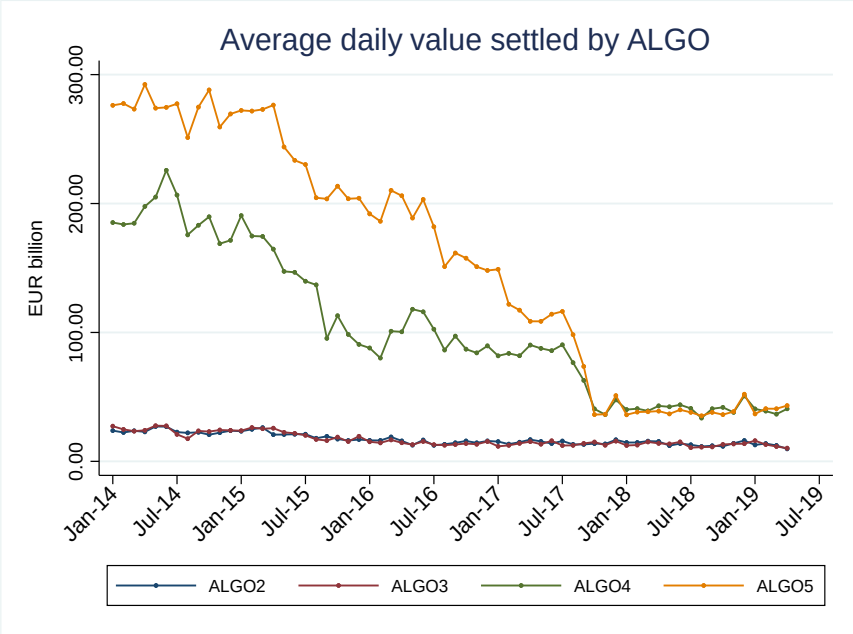
TARGET annual report 2010, Box “Liquidity saving features and their use”

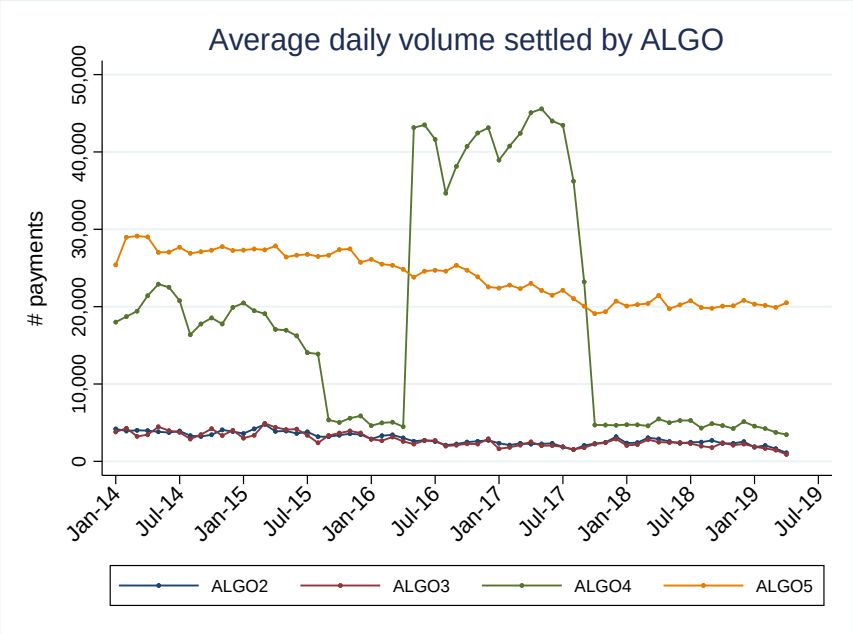
TARGET annual report 2012, Box “Analysis of liquidity-saving features in TARGET2”

Usage of LSM in TARGET2

Average daily value settled

in value (left panel), in volume (right panel)





- ALGO2 and ALGO3 are the most stable in both value and volume, while ALGO5 and especially ALGO4 exhibit higher volatility.
- The peak of usage between April 2016 and November 2017 is due to the temporary migration of one AS to gross settlement.

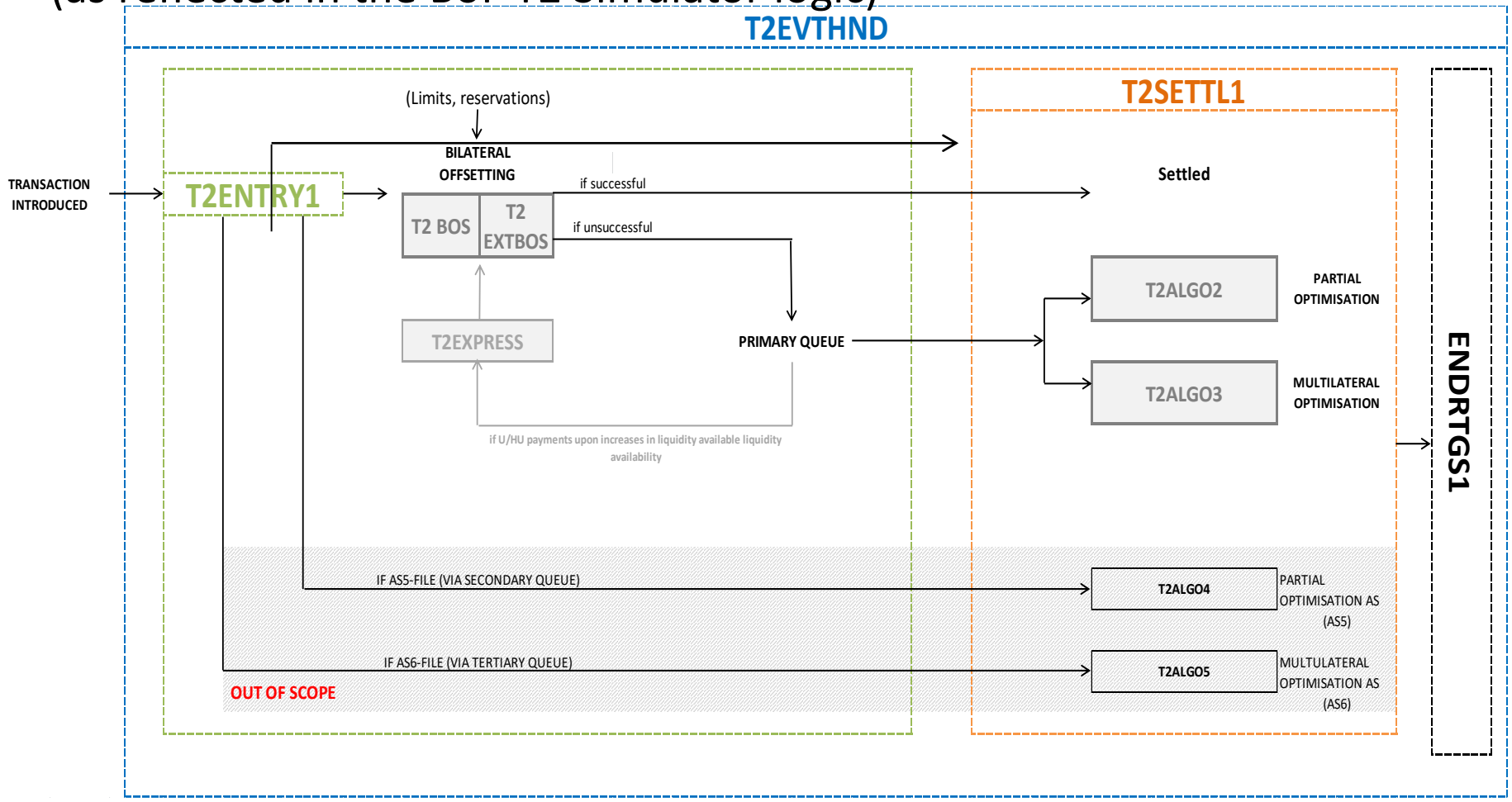
Input data

Year	Value processed in TARGET2 (€ bn)	Volume processed in TARGET2	TARGET2 traffic in value (€bn)	TARGET2 traffic in volume	Participants	Start date	End date
2014	2,550.13	372,018	1,910.91	367,486	1,442	24-Feb	07-Mar
2015	2,626.94	369,161	2,001.78	365,025	1,481	23-Feb	06-Mar
2016	2,850.07	348,013	1,782.36	344,082	1,484	22-Feb	04-Mar
2017	2,984.76	389,295	1,744.87	367,475	1,583	20-Feb	03-Mar
2018	3,227.55	360,250	1,691.50	358,003	1,566	26-Feb	09-Mar
2019	3,082.68	360,433	1,767.99	358,269	1,505	25-Feb	08-Mar

Note: all figures are expressed as daily averages. The values and volumes processed in TARGET2 include all payment categories and types (except overnight deposits) and settlement statuses. The TARGET2 traffic in value and volume is calculated in line with the statistical framework, thus excluding technical and liquidity transfers (payment categories 0.0, 4.4, 4.6, 4.7, 4.8, 4.9) and payments related to the use of standing facilities. The number of participants is calculated at BIC11 level and includes both published and unpublished BICs.

Simplified TARGET2 settlement process

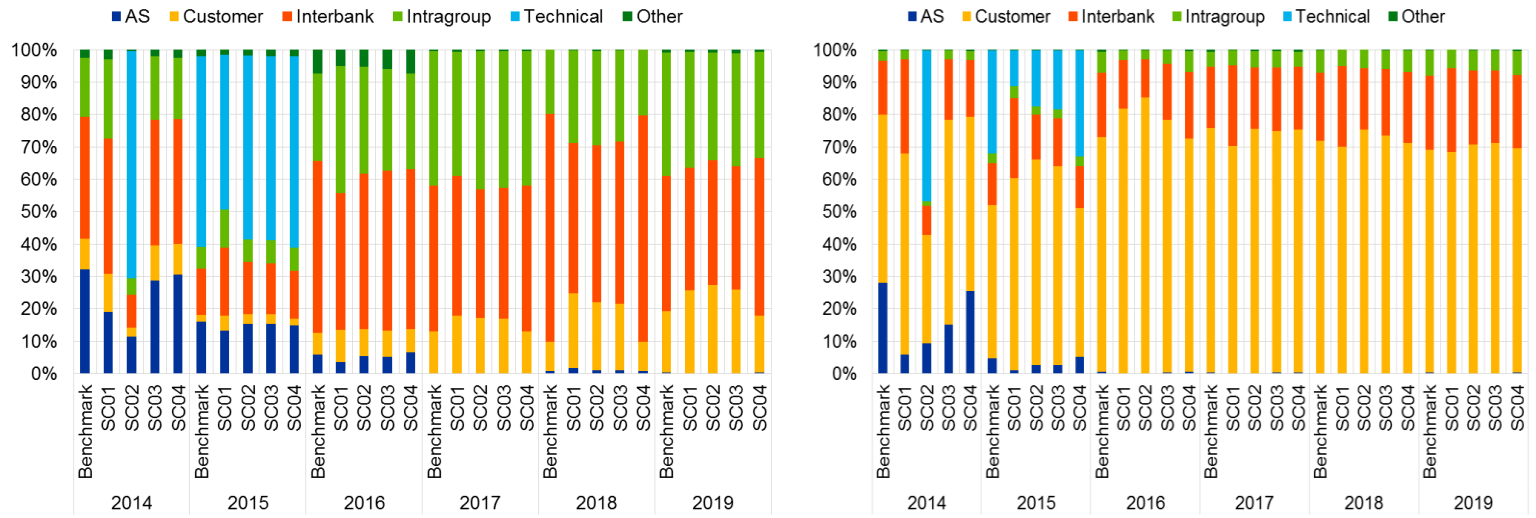
(as reflected in the BoF T2 Simulator logic)



ALGO4 and 5 excluded from analysis as inherent to the settlement of ASI5 and ASI6, i.e. settlement would completely fail without.

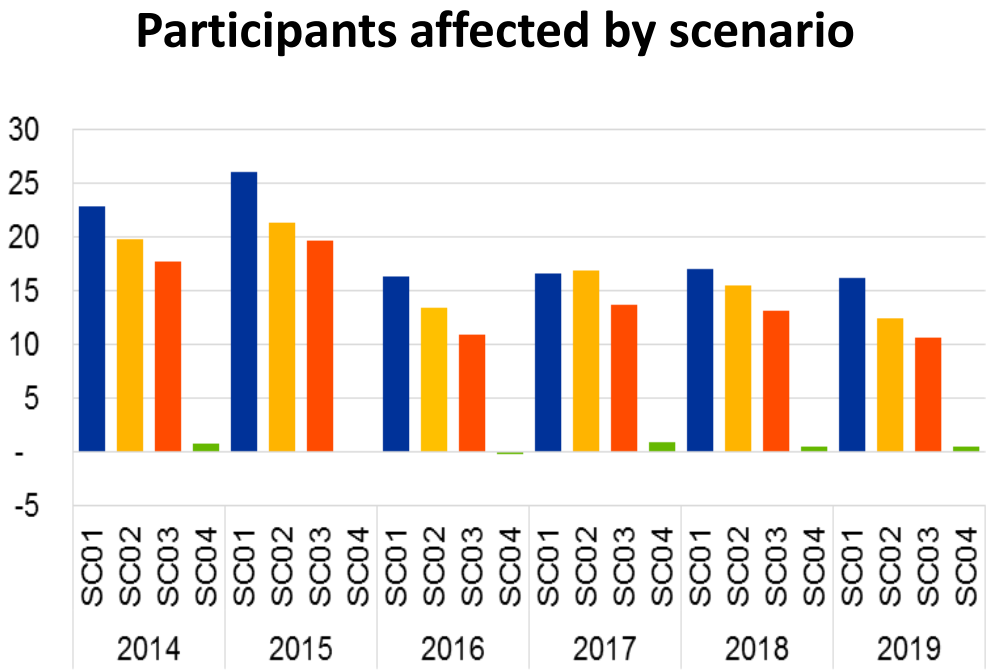
Results

Unsettled transactions by transaction type
in value (left panel), in volume (right panel)



- The composition of unsettled transactions varies across years, with ancillary systems (AS) payments representing almost one third before the T2S migration.
- Compared to the benchmark, the categories affected by unsettled payments in the scenarios are mainly customer payments in volume, interbank and intra-group payments in value.

Results



- The number of participants affected by unsettled payments decreases as the system configuration moves from a plain RTGS system to a system close to TARGET2.
- Marginally less participants are affected in presence of higher liquidity levels in the system and with the migration of AS to T2S.