Liquidity impacts of migration to instant payments

Economics of Payments X, October 2021

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Outline

1. The goal and motivation
2. Model setup and assumptions
3. Generation and validation of artificial data
4. Results based on the generated data
   - Liquidity needs
   - Regression model for the additional liquidity

The goal and motivation of this study

- Migration of retail payments to instant payments (IP) is gradually taking place
- European retail payment strategies aim at full deployment of instant payments
  - What are the obstacles?
  - Are there increased liquidity risks?

Is increased liquidity need a relevant issue? We answer this question for the Finnish market

STEP2 and RT1

- Ancillary systems of TARGET2 operated by EBA Clearing s.a.s. which settle most of the Finnish retail transactions
- STEP2
  - 15 Finnish participants
  - Settlement in 2 night time and 5 day time cycles
  - Multilateral net liquidity need for payments in a cycle (all or nothing)
  - Continuous gross settlement mode forthcoming
- RT1
  - Instant payments: full liquidity needed separately for each payment
  - Increasing share of volumes, still below 10% in Jan 2020

Available STEP2 Data (FI) for 01/2020

- Monthly averages by participant and by cycle
  - **Value** and **volume** sent
  - **Value** and volume received

- Monthly Total number of payments by size category
  - Estimated to follow a log-normal distribution

…but we do not have transactions
- Timing of individual payments inside the cycles
- Variation between different days
- Structure of the retail flows – who pays to whom

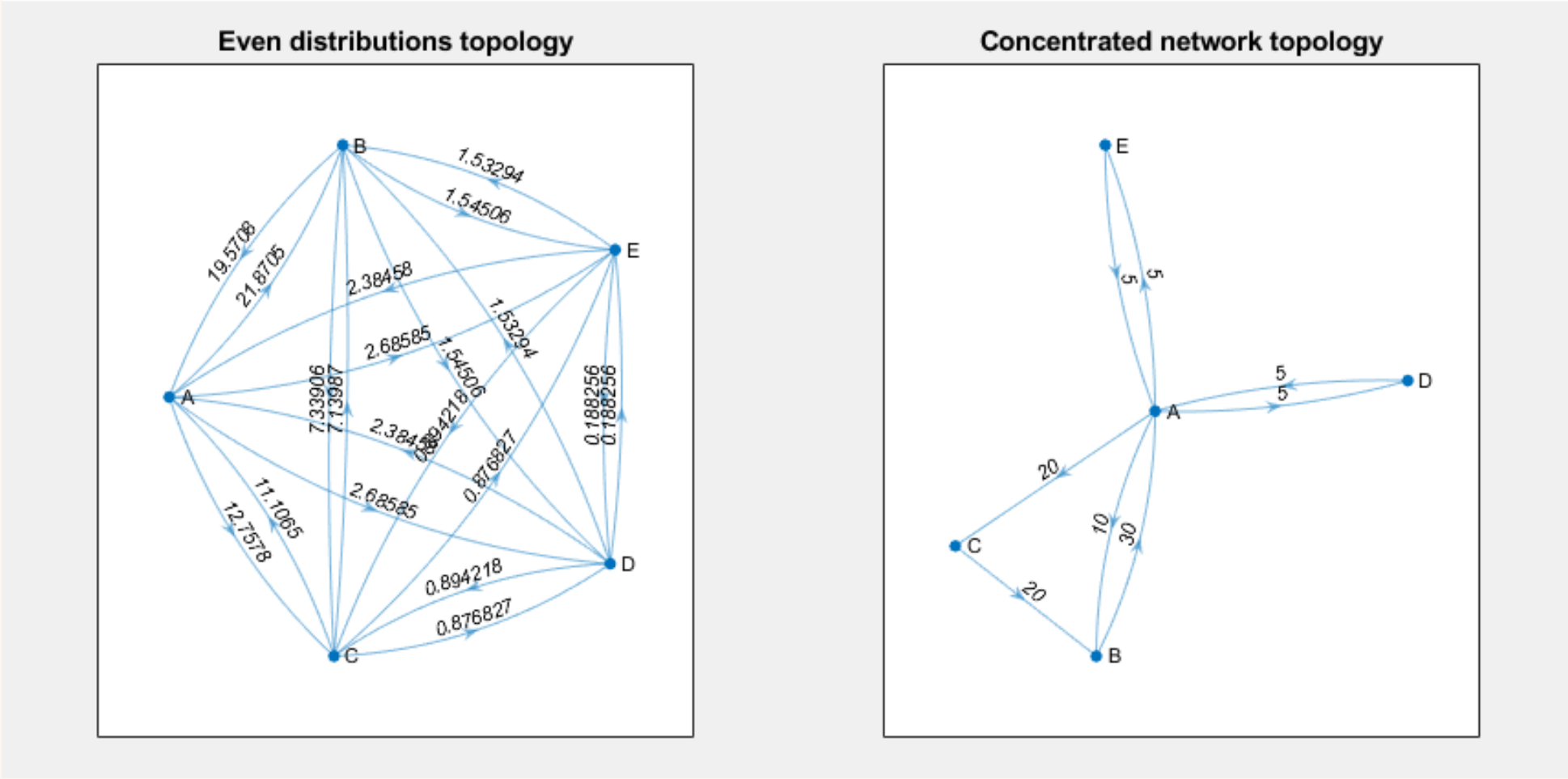
sct 01 January 2020 - Breakdown By Amount
Classification: Closed User Group

Description	Volume
< 1,250	30 764 838
>= 1,250 and < 12,500	3 523 563
>= 12,500 and < 50,000	277 611
>= 50,000 and < 250,000	67 774
>= 250,000 and < 1 m	10 985
>= 1 m and < 10 m	3 405
>= 10 m and < 25 m	252
>= 25 m and < 50 m	29
>= 50 m and < 100 m	32
>= 100 m and < 500 m	4
>= 500 m and < 1 mrd	0
>= 1 mrd	0

Generation of artificial transaction data

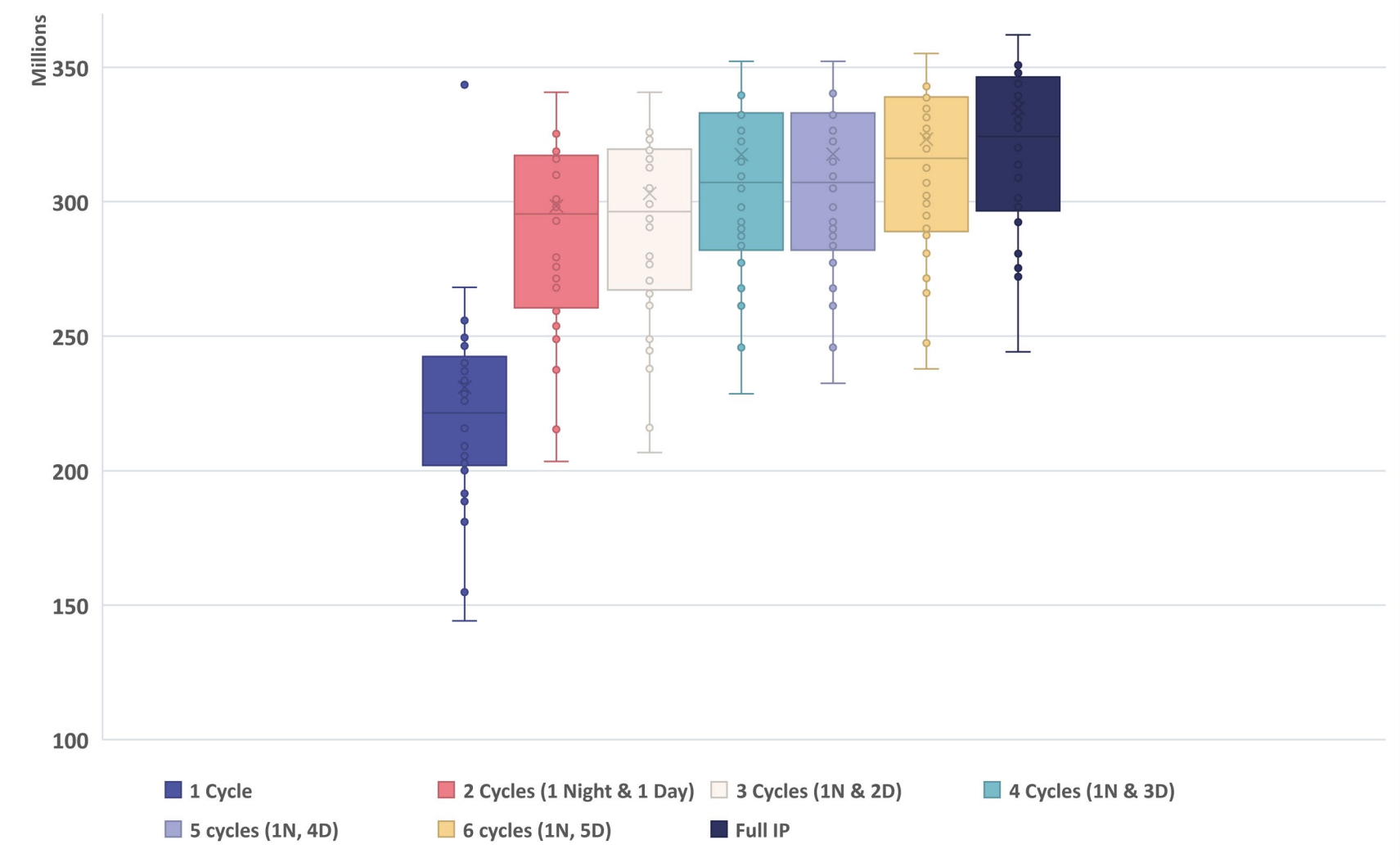
- For each bank (n=15) by cycle on a daily level :
  - Random time interval between two sent payments (Poisson distribution) => correct **number of sent payments** for one bank in one cycle
  - Random transaction value (log-normal distribution):
    - Match the total **value of payments sent** by one bank in one cycle
    - Match the monthly **value distribution**
  - Receiver distribution 2 topology alternatives used:
    - Fully connected “Even distribution” and star like “concentrated topology”
    - Correct **values for received payments**
- In total
  - Monte Carlo simulation 2 x 1000 days
  - ~1,5 mil. transactions per day

Topologies illustrated: Even distribution and concentrated

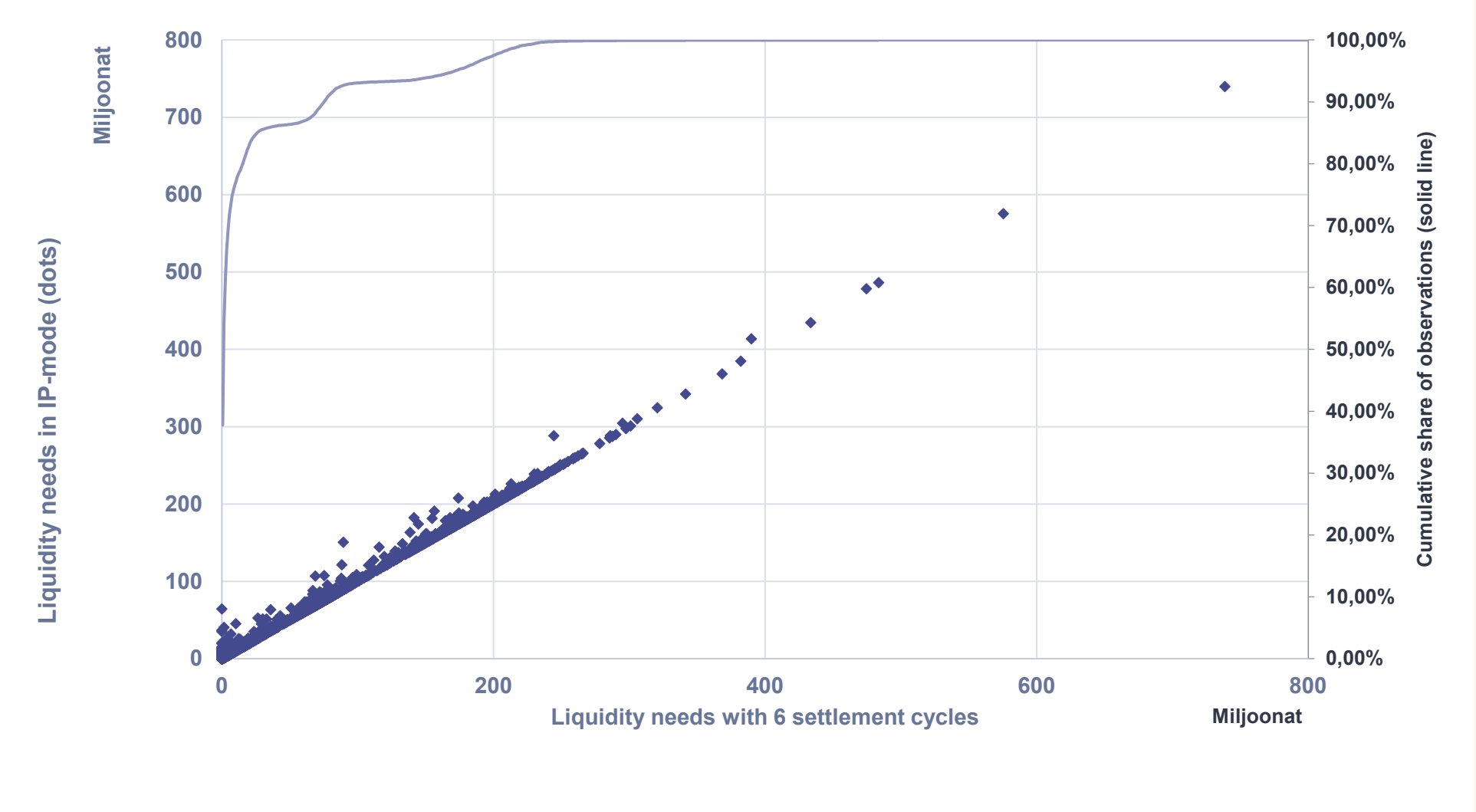


Liquidity need distributions per settlement mode

- With BOF-PSS3
- 65% of total liquidity increase
  when moving from
  1 daily cycle to
  2 cycles

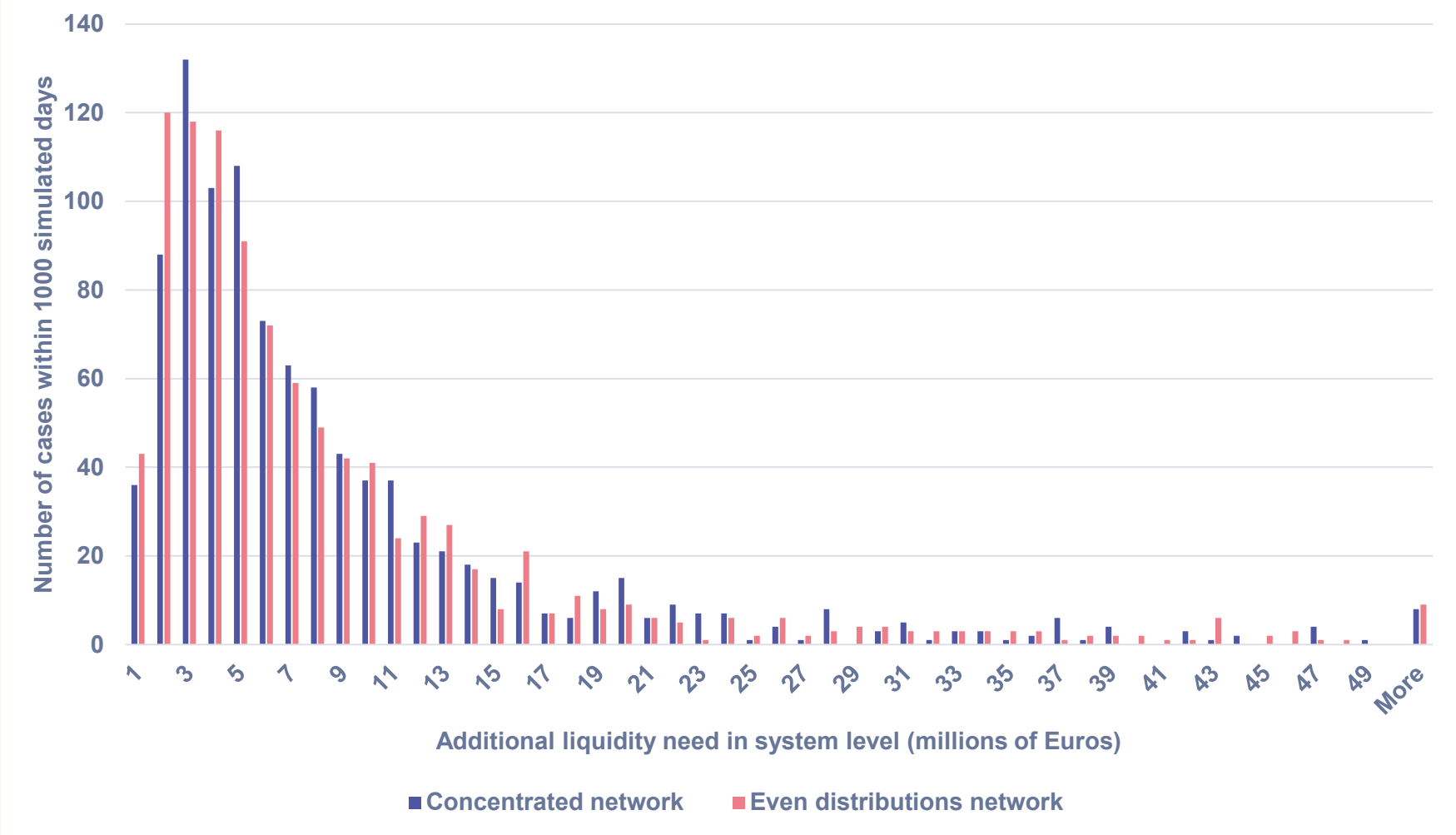


Additional liquidity need on participant level



System level liquidity increase from current STEP2 to full IP

- 95% of cases < 8.7% or < 28 million
- Avg. 2.7 % or 8.6 million



Impact of network topology

- Topology **does not impact** the liquidity needs
  – at least in the current setup

- Why so?
  - It doesn't matter where payments come and go when account level aggregates are controlled
  - We don’t have stress scenarios
  - All banks are migrated in one go to IP

Regression for additional liquidity need

- Level of individual cycle and one participant
- Independent variables from statistics, dependent from generated data

Stepwise round	1	2	3	4	5
R-squared	0.434	0.61	0.671	0.801	0.833
	Variable coefficients				
Constant	-6.4692e-17	-7.3341e-17	-9.2705e-17	0.046958 (**)	0.042706 (**)
Value sent	0.62078 (***)	1.0306 (***)	1.4415 (***)	1.6062 (***)	1.4308 (***)
Abs net position	-	-0.98237 (***)	-0.76757 (***)	-0.66731 (***)	-0.47732 (***)
Liq. recycling	-	-	-	-	0.4105 (***)
Sent volume	-	-	-0.69769 (***)	-0.31243 (*)	-0.34443 (**)
Sent volume * value sent	-	-	-	-0.95128 (***)	-0.83488 (***)
P-value of of the test to include / exclude a variable	1.68205e-12	1.44141e-08	1.45389e-06	5.47608e-09	0.0044938
F-stat	67.4908	39.1269	26.8146	42.1133	4.0962

Prediction example

	Bank 1, cycle 1	Bank 2, cycle 1
Description	Balanced liquidity flow (low net position) and small number of payments	Unbalanced liquidity flow (high net position) and large number of payments
[a] Value of sent payments in thousand euros	100 000	100 000
[b] Net position (abs. value) in thousand euros	100	10 000
Liquidity recycling = [a / b]	1000	10
Number of sent payments	1 000	10 000
Expected average additional liquidity need	34.6 million euros	534 thousand euros

Summary

- Migration to full IP is likely to cause (eventually) minor liquidity increases for the banks. Still the relative increase can be large if original need was small
- Liquidity savings decrease quickly when cycles are added
- We can predict the magnitude of likely liquidity increase on participant level
- Topology of the network has negligible impact - at least when all are in IP and operating normally
- Timing for the migration to IP might be perfect just now
- Data generation allows analysis when only aggregate statistics are available

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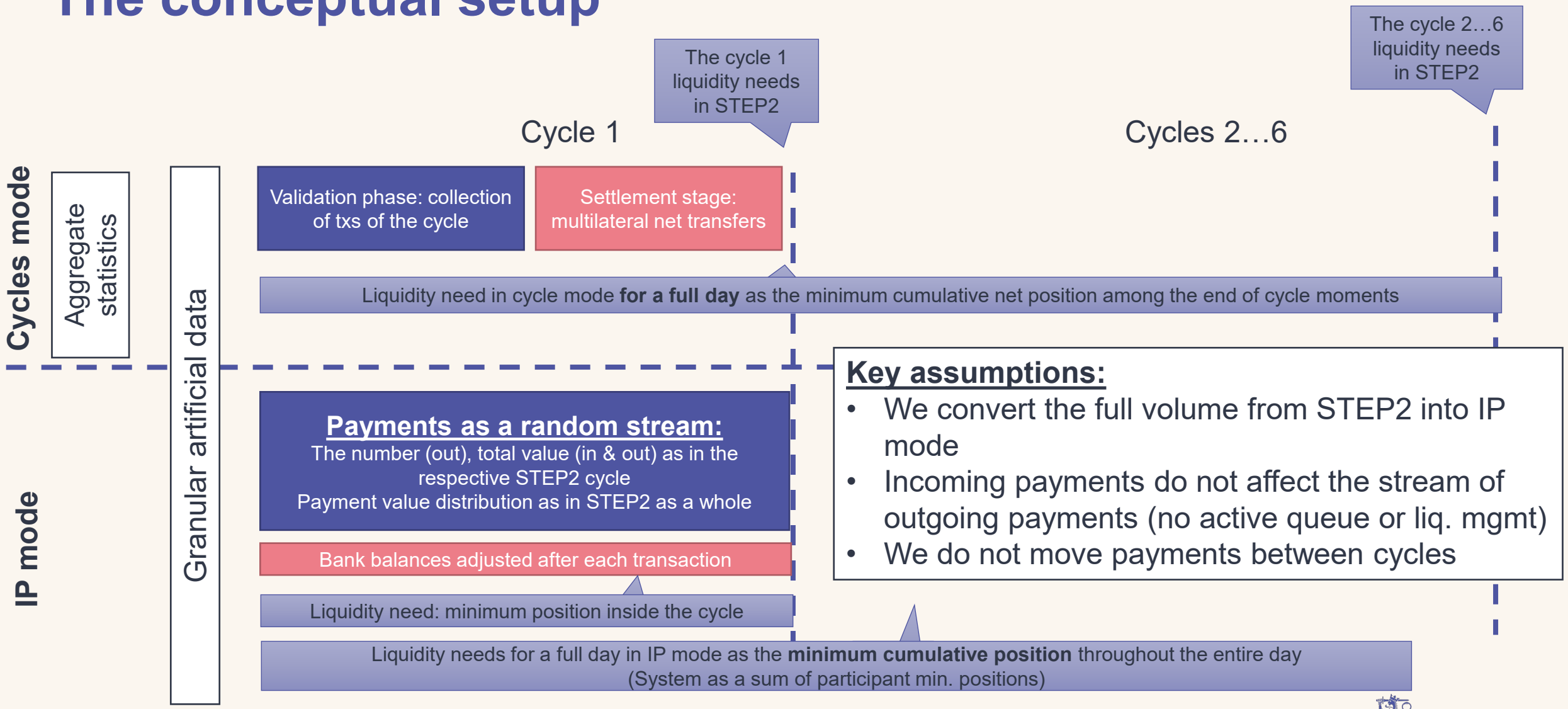
Thank you!

Extra slides

The conceptual setup



Used liquidity indicators

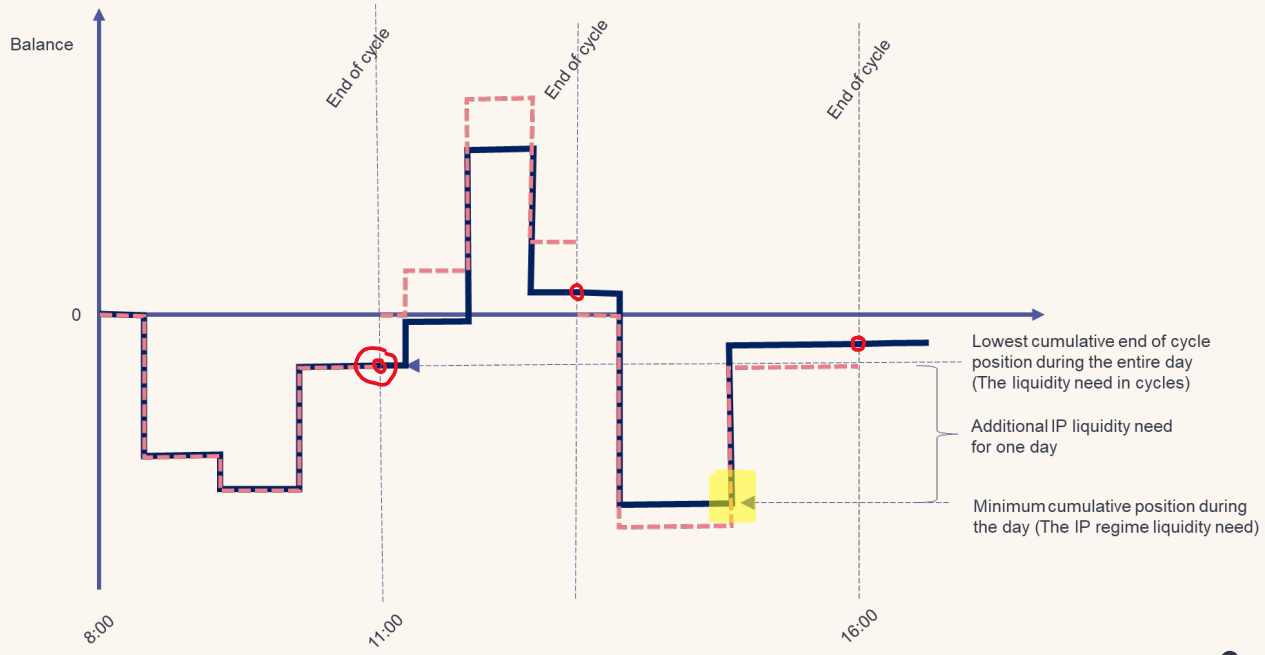


Illustration of position of one bank with three cycles

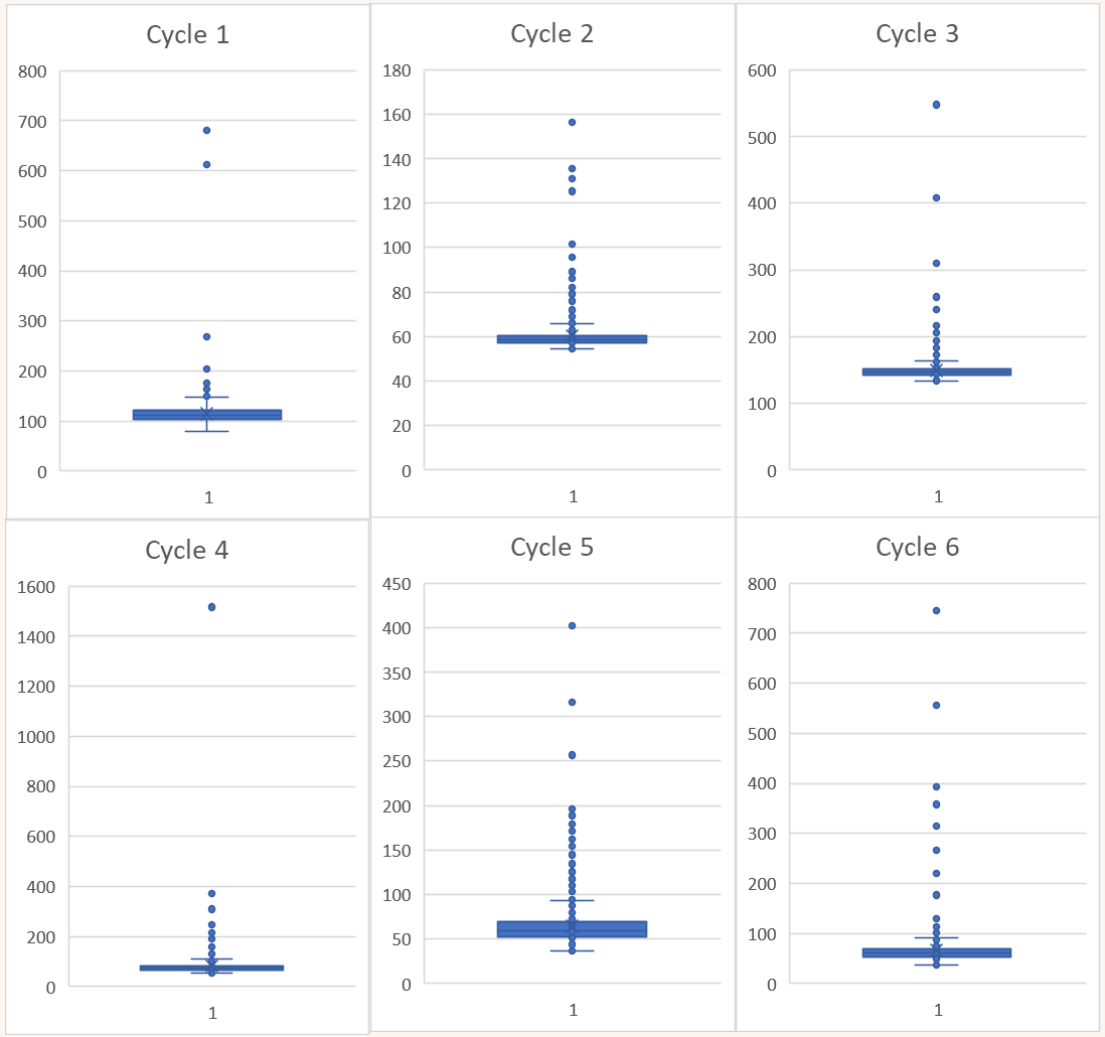
Full day indicators

- **Liquidity need in IP mode**: minimum position throughout the full day ("upper bound of liquidity")
- **Liquidity need in cycles**: minimum position among the 6 *end of cycle net positions;* the current setup
- Additional liquidity need as the difference

- The same indicators for each cycle separately (pink dashed lines)

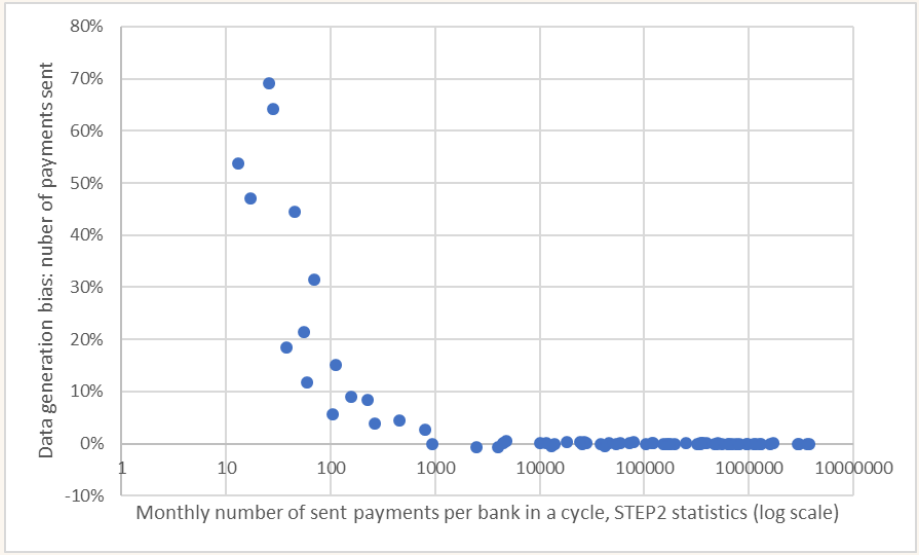
Liquidity need at cycle level

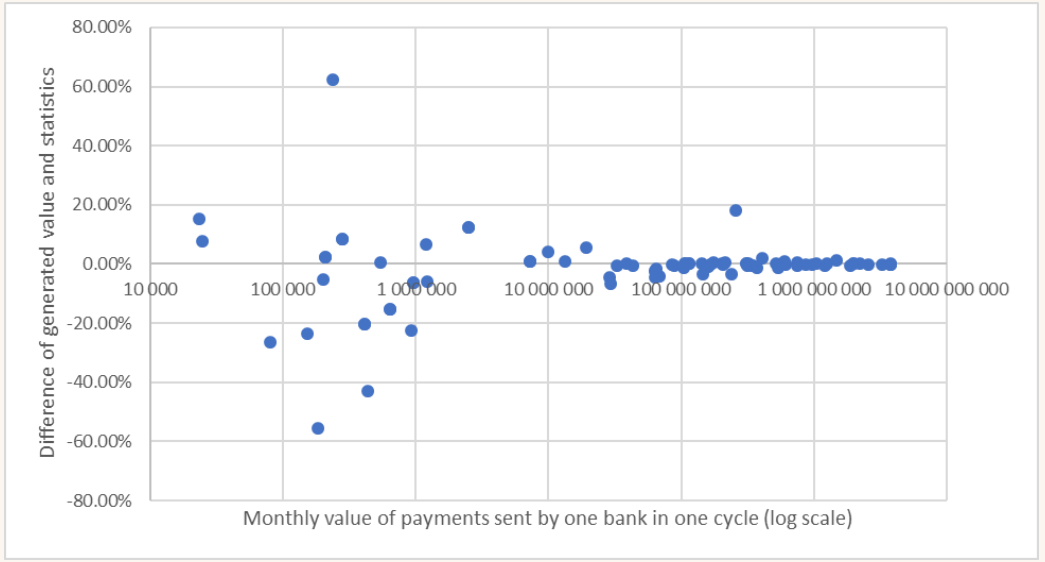
- System level additional liquidity need separately in each cycle
- Majority of the observations have small variation
- Large outliers possibly due to data generation process



Validation of data generation, sample of 1000 days

- Value and volume of payments sent
  - Very accurate on system level (-0.012% and 0.002% differences on avg)
  - Accurate for large senders
  - Somewhat noisy for the smallest senders (or even biased for the volumes)





Value distribution

- ..is in general well replicated
  - Largest payments underrepresented, less so in value-weighted view