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Does limited use of limits limit the use of limits?
11th Payment and Settlement System Simulation Seminar

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Does limited use of limits limit the use of limits?
Disclaimer

The results presented are preliminary and the views expressed do not necessarily reflect the views and opinions of the Deutsche Bundesbank.

Does limited use of limits limit the use of limits?
Agenda

– Limits among the tools for liquidity management in TARGET2

– Descriptive Analysis

– Simulations

– Interpretation

– Outlook

Does limited use of limits limit the use of limits?
Limits among the tools for liquidity management in TARGET2

Limits among the tools for liquidity management in TARGET2
Overview

T2 offers a wide range of liquidity management features:

– Priorities (normal, urgent, highly urgent)

– Reservations for different priorities

– Reservations for ancillary systems

– Manual intervention via ICM

– **Bilateral and multilateral limits**

Use of limits

– support for risk management (of participant and of operator)

– smoother flow of payments (liquidity efficiency)

– particular treatment for critical payments

  • time critical

  • important

Limits among the tools for liquidity management in TARGET2
Goals of the analysis

– Describe the use of limits by the participants (payment patterns)

– Investigate the possibilities of using limits to derive participant based or system wide indicators

– Analyze the impact of limits on the system

– Derive recommendations for oversight and operators

Limits among the tools for liquidity management in TARGET2
Impacts of limit – theoretical considerations

– Individual Participant:
  - Liquidity saving effect, intraday credit use reduced
  - Risk is reduced

– System Level
  - First round effect: Liquidity efficiency could be reduced
    - Payments are not settled/are postponed
    - Could lead to a gridlock in extreme cases
    - Relevant especially in an environment with high liquidity
  - Second round effect: Liquidity distribution could become more efficient
    - Assumption: Limits are set against „late payers"
    - Liquidity will be directed towards „early payers"
    - Relevant especially in an environment with scarce liquidity
    - Number of queued/unsettled payments does not necessarily increase with limits

Limits among the tools for liquidity management in TARGET2
Impact of limits – example with three participants (1)

Liquidity Provider		
Own liquidity		20
time	**To**	**Sum**
1	Free-rider	10
3	Early Payer	10
5	Free-rider	10
7	Early Payer	10
9	Free-rider	10
11	Early Payer	10

Early Payer		
Own liquidity		20
time	**to**	**sum**
2	Liquidity provider	10
4	Free-rider	10
6	Liquidity provider	10
8	Free-rider	10
10	Liquidity provider	10
12	Free-rider	10

Free-Rider		
Own liquidity		0
time	**To**	**Sum**
13	Liquidity provider	10
14	Early Payer	10
15	Liquidity provider	10
16	Early Payer	10
17	Liquidity provider	10
18	Early Payer	10

- Three Cases:
  - no limits
  - limit of 10 from Liquidity Provider against Free-Rider
  - limits of 10, each from Liquidity Provider and Early Payer against Free-Rider
- Rules:
  - Settlement according timing
  - payments queued if liquidity insufficient or if limit is hit
  - queued payments are settled as soon as possible

Limits among the tools for liquidity management in TARGET2
Impact of limits – example with three participants (2)

Result

	no limits	1 limit	2 limits
average settlement time	11,7	12,0	12,2
average volume of queued payments	25 %	29 %	37 %
liquidity sunk at Free-Rider	65 %	49 %	37 %

- More limits mean
  - average settlement time increases (little)
  - queues become larger (significant)
  - liquidity sunk at free-riders is reduced (significant)

Does limited use of limits limit the use of limits?
Descriptive Analysis: Use of bilateral and multilateral Limits

Descriptive Analysis
Overview

– Participants:
- Total: 23 senders, 932 receivers
- Average: 17 senders, 601 receivers

– Limits
- Average 1862 „transactions" (limit or deletion) per day
- Average 1048 new limits, of which 1034 are bilateral limits
- Average 814 deletions of limits

– Standard Pattern
- 99% of the observations are either a new limit as first transaction or a deletion as second transaction of the same day within the same sender-receiver combination
- Deletion of a bilateral limit only once per day and without setting a new limit afterwards
- Maximum of 7 „transactions" per day within the same sender-receiver combination

Descriptive Analysis
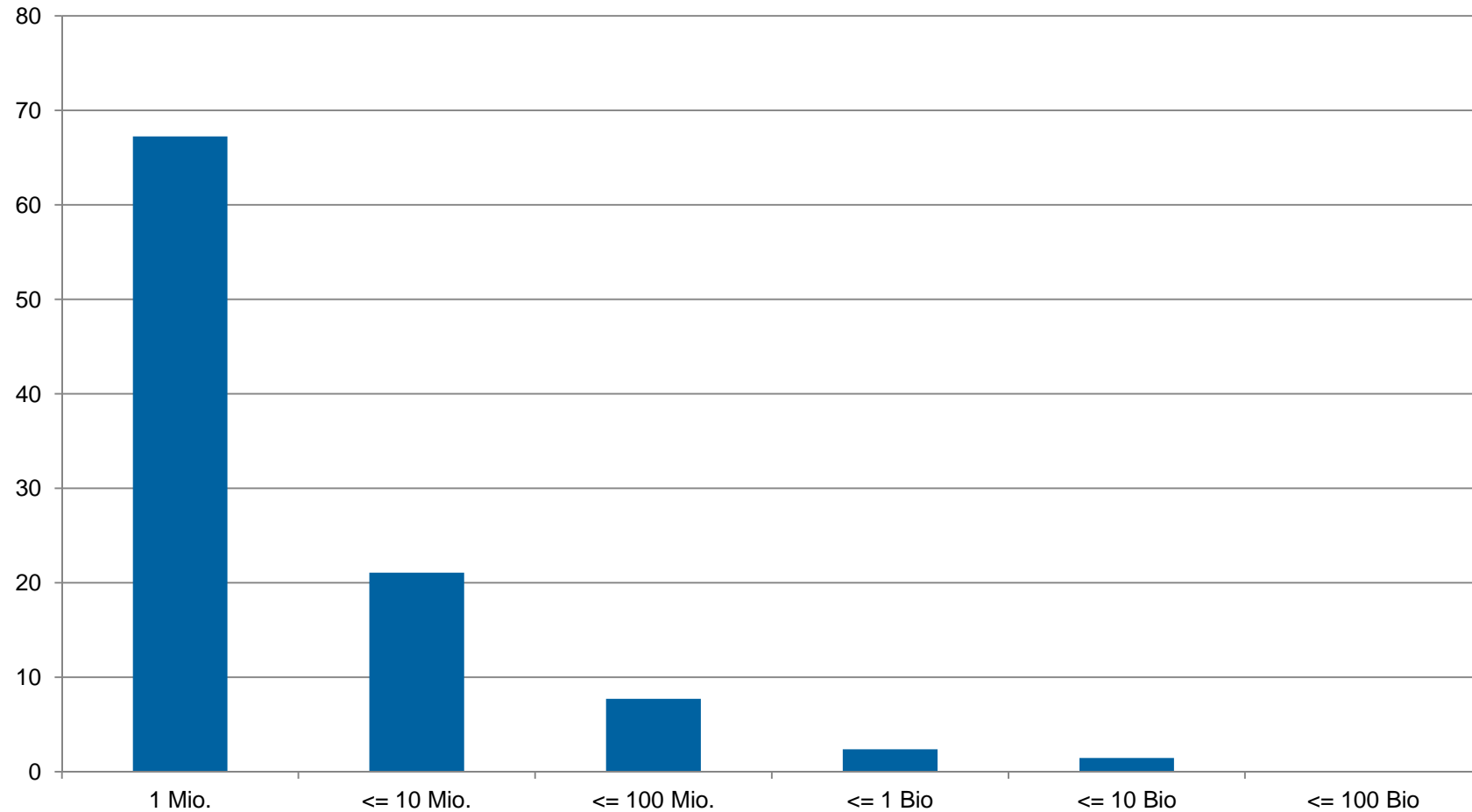**Number of limits and participants using/receiving limits**
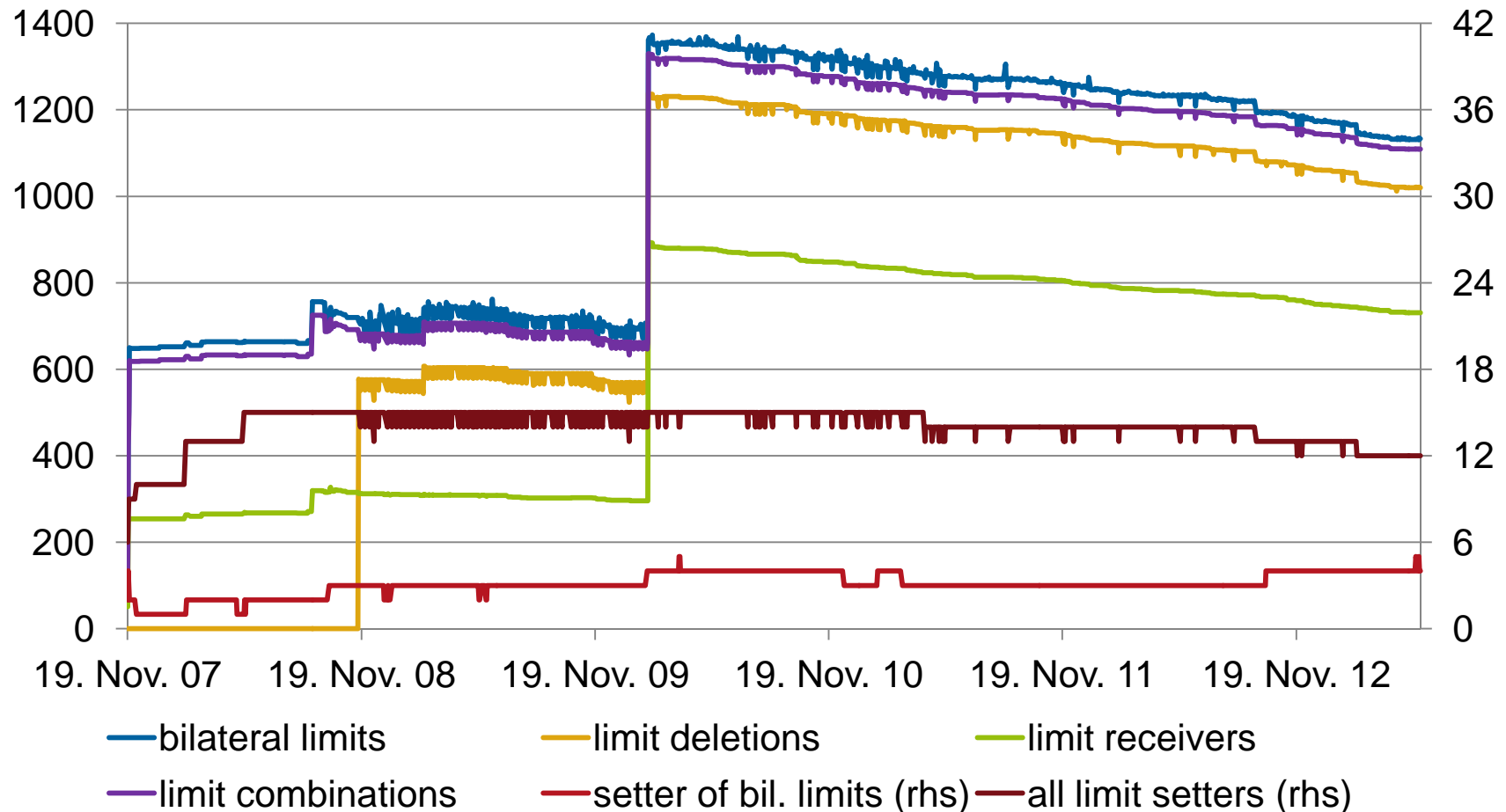
Legend:
- bilateral limits
- limit deletions
- limit receivers
- limit combinations
- setter of bil. limits (rhs)
- all limit setters (rhs)

Descriptive Analysis
Values of Limits – Bilateral Limits (in percent)

Descriptive Analysis
Values of Limits – Multilateral Limits (in percent)
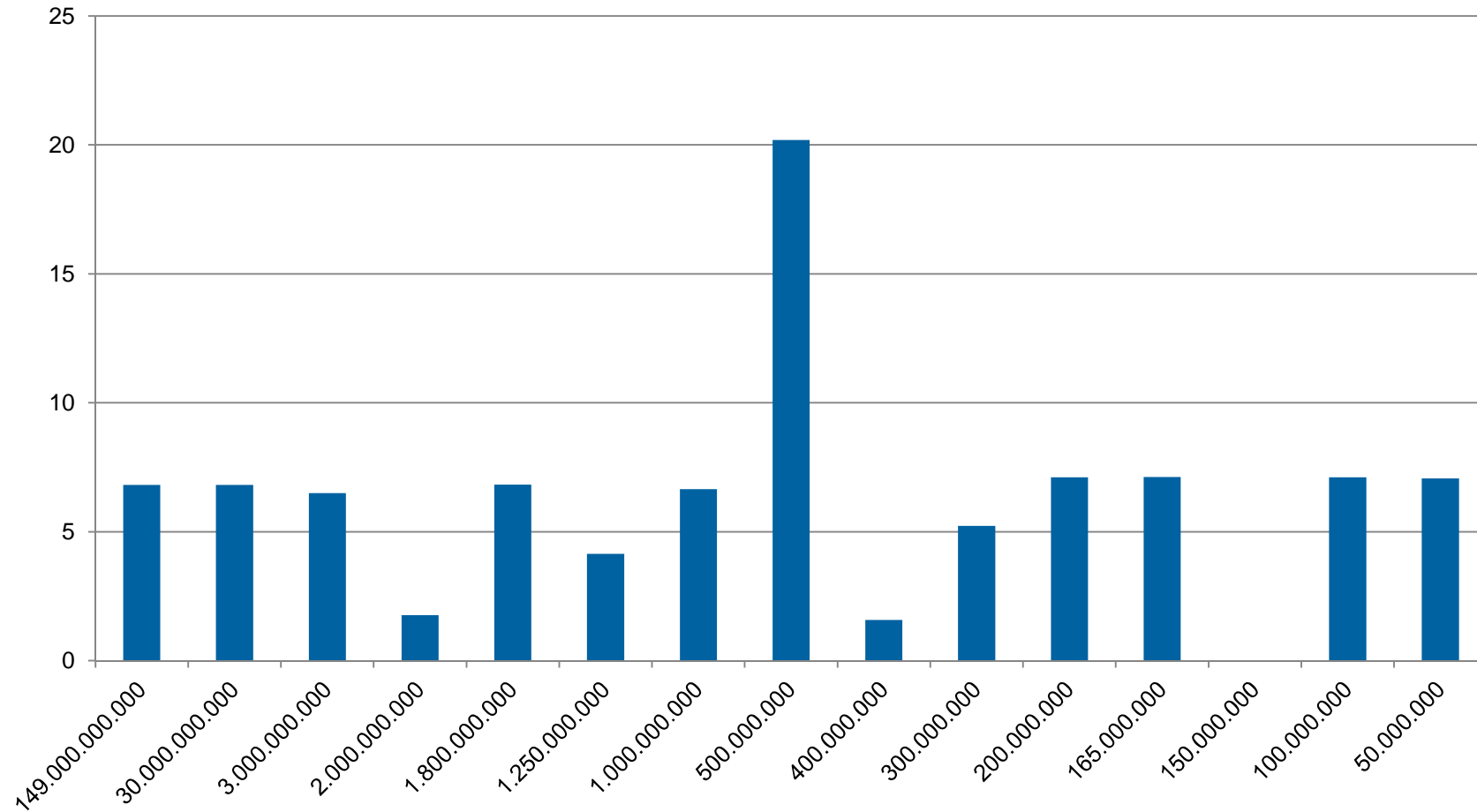
Descriptive Analysis
Value of Limits – time series

Legend: bilateral limits — multilateral limits — avg multilateral limit (rhs) — avg bilateral limit (rhs)
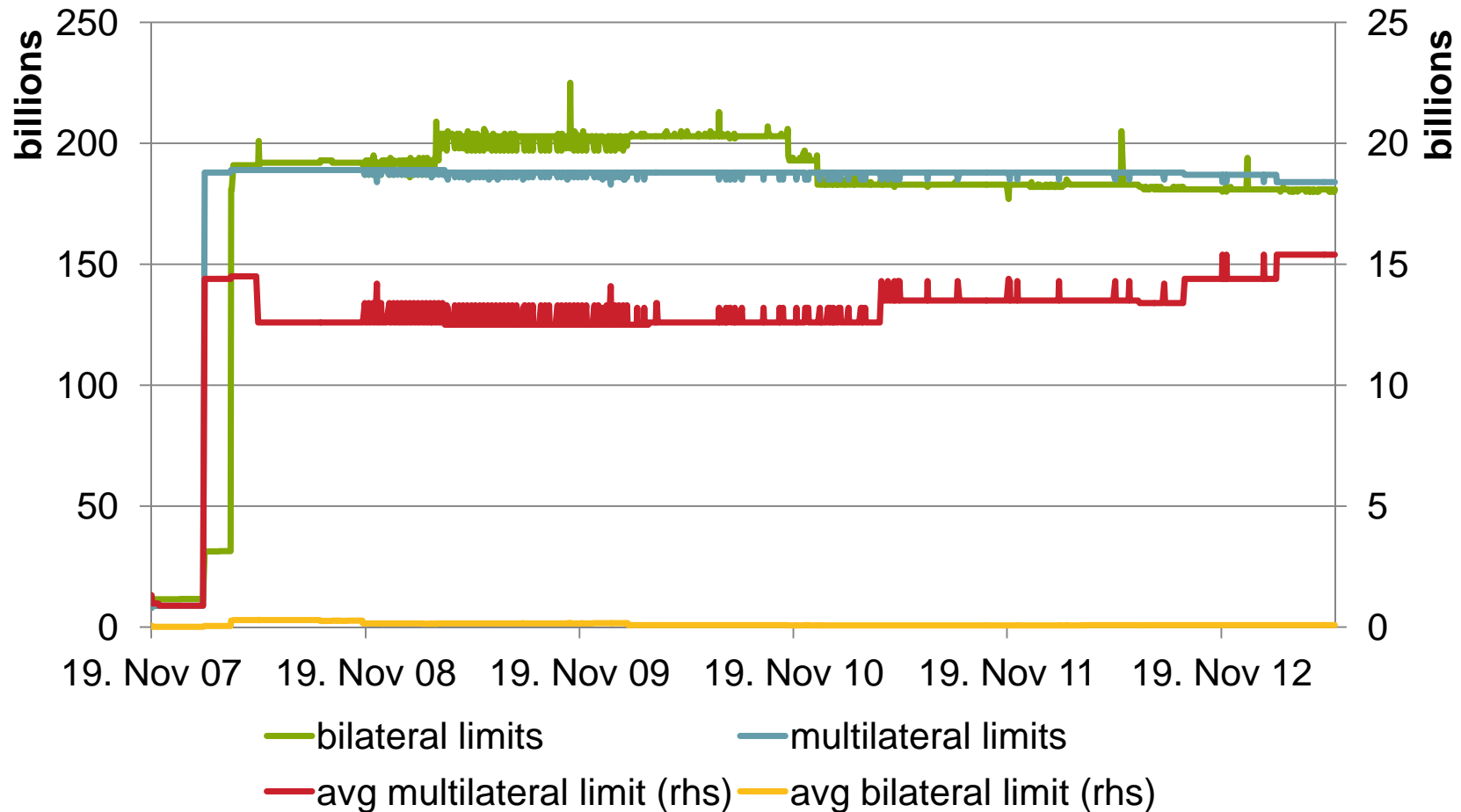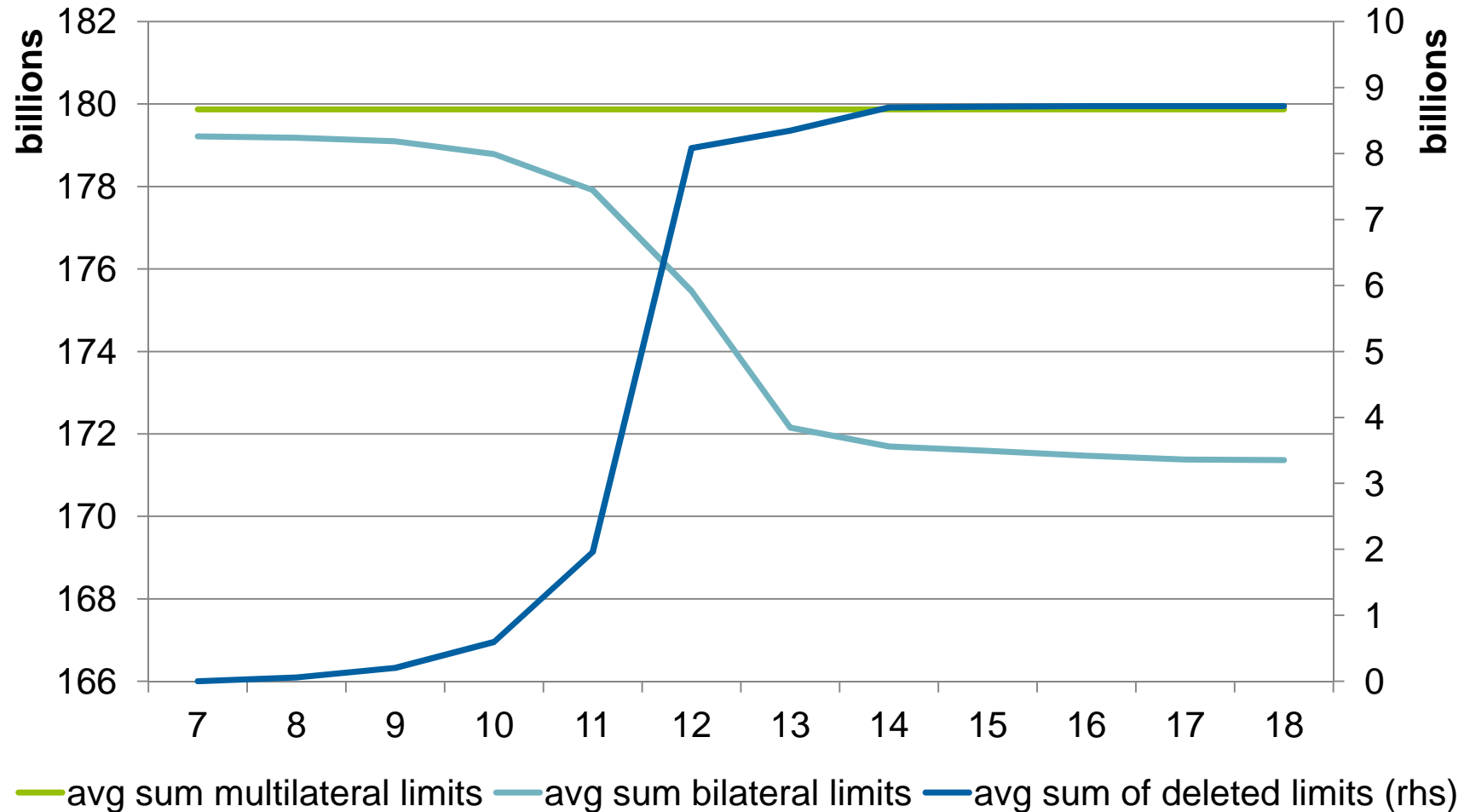
Descriptive Analysis
relative importance of limits

- share of debitors using limits: 2 per cent
- share of creditors facing limits by creditors: 73 per cent

- in comparison to regular payments
  - share of sum of bilateral limits: 14 per cent
  - share of sum of multilateral limits: 14 per cent

- different limit combinations: 1076
  - connectivity: 0.2 per cent

- share of reciprocal limits:
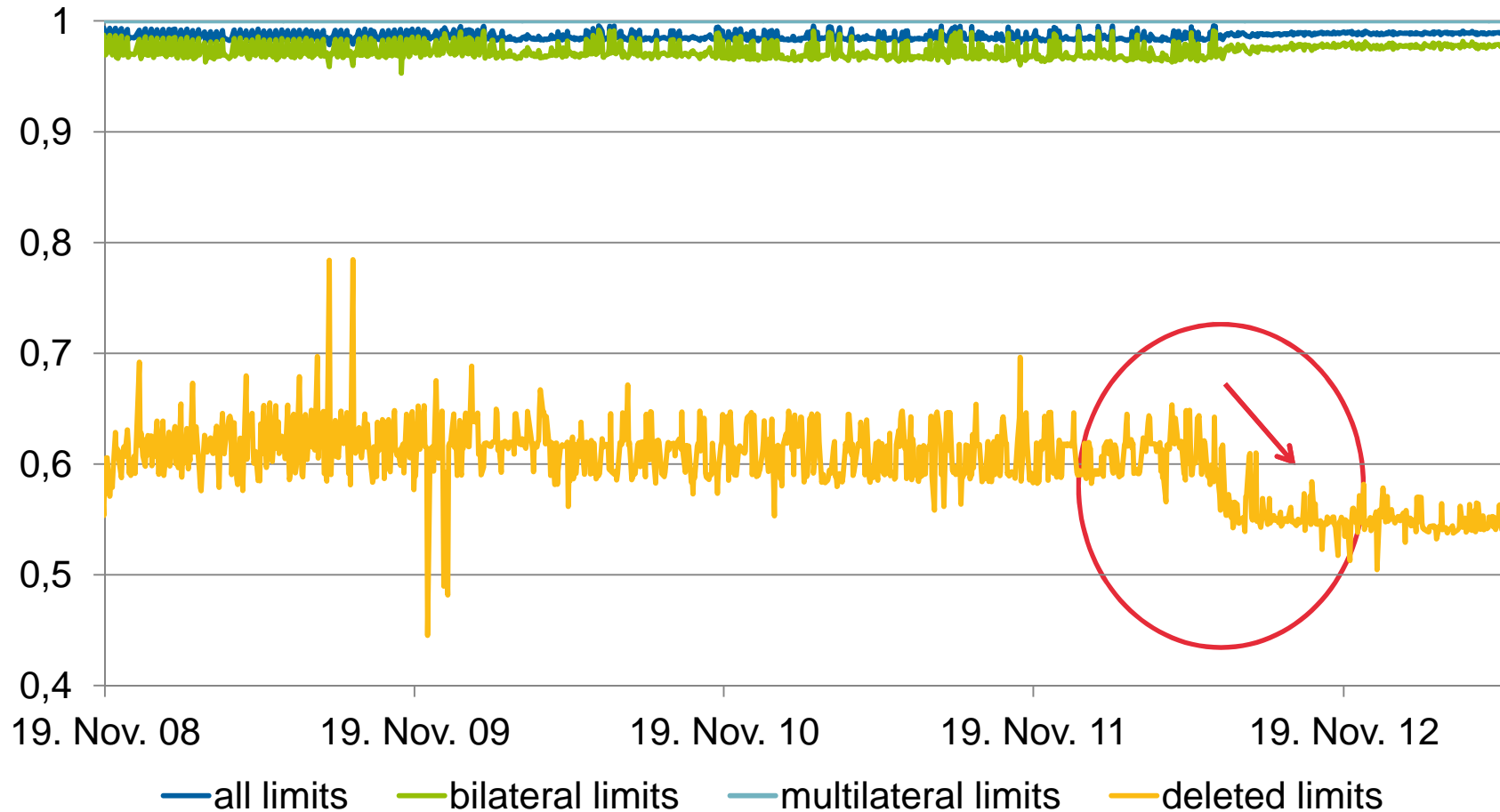 - by number: 4 per cent
  - by sum: 19 per cent

Descriptive Analysis
average timing of limits/deletions

avg sum multilateral limits — avg sum bilateral limits — avg sum of deleted limits (rhs)
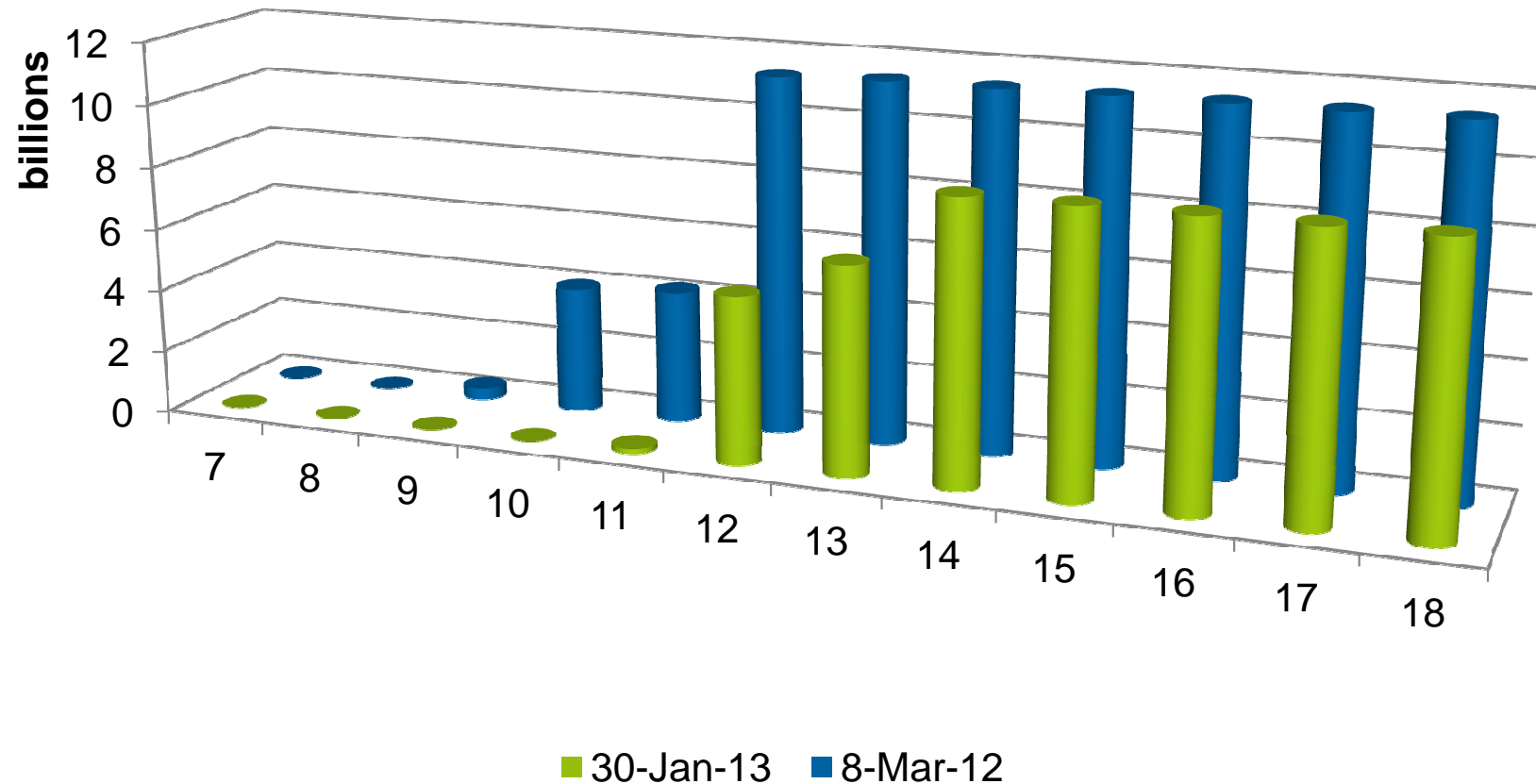
Descriptive Analysis
Intraday timing of limits/deletions

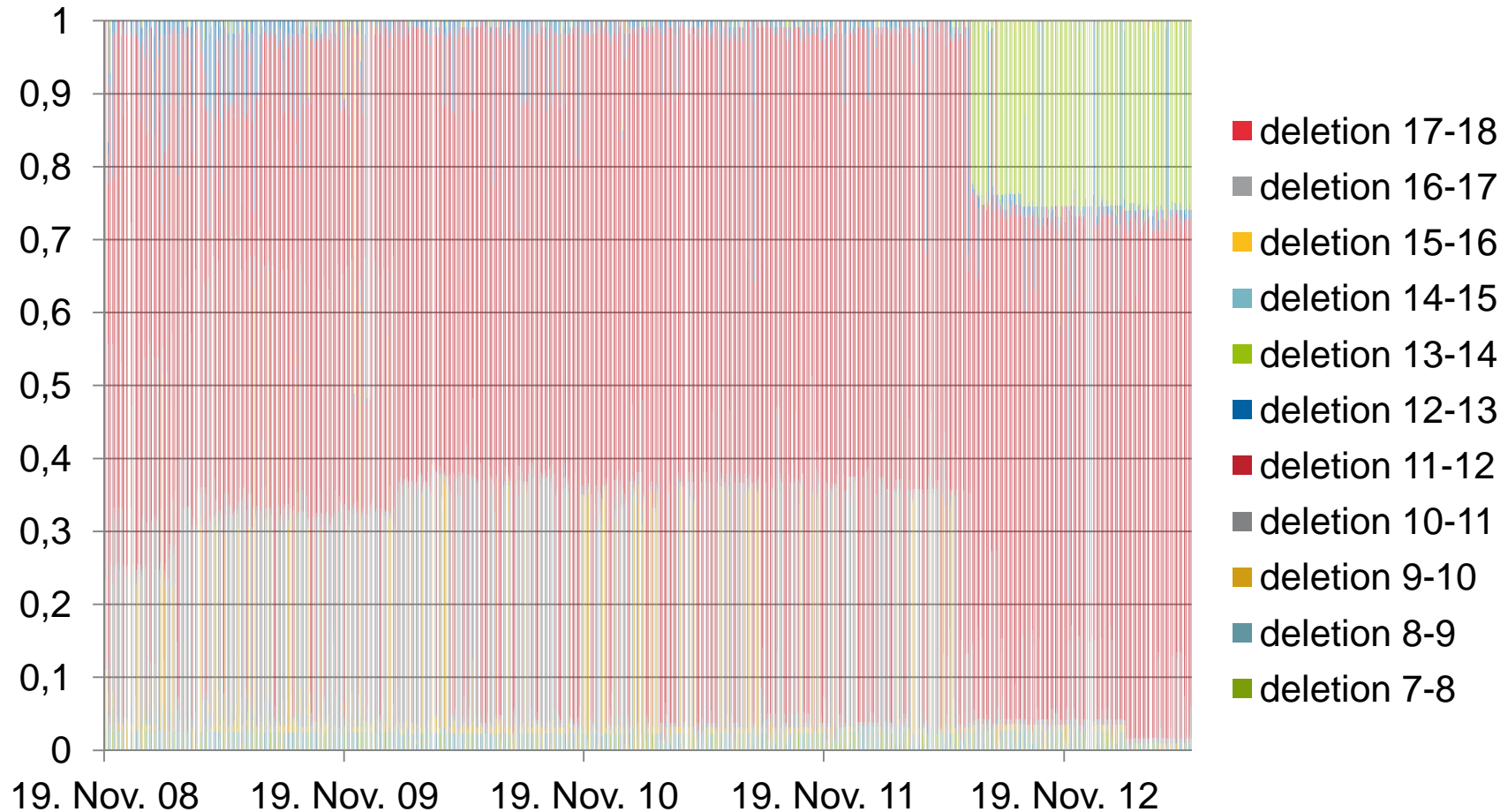Index= 1 (0) means all limits/deletions are valid from 7 a.m. (6 p.m.)

Descriptive Analysis
Intraday timing of limits/deletions: example

30-Jan-13   8-Mar-12

Descriptive Analysis
Intraday timing of limits/deletions: share of time-bands

Legend:
- deletion 17-18
- deletion 16-17
- deletion 15-16
- deletion 14-15
- deletion 13-14
- deletion 12-13
- deletion 11-12
- deletion 10-11
- deletion 9-10
- deletion 8-9
- deletion 7-8

Does limited use of limits limit the use of limits? Simulations

Simulations
Scenarios and setup

– Time periods investigated: 01/13 and 05/13

– Basic scenario
  - Simulation of the entire month
  - 13XX basis, trying to replicate real T2
  - Compare with „No limit scenario" 13XX without limits
    · Data not manipulated. Limit data excluded
    · Simulating T2 without any limits

– Stress scenario
  - Data manipulated: ICCL reduced to 10%
  - Days of one month simulated separately
  - Simulation of „Limit" and „No Limit Scenario"

Simulations Results

Basis Scenario

- System Level Statistics:
  - No. of unsettled payments decreases in the „No Limit Scenario"
  - but not on every single day.
- Queue Reason Statistics:
  - total queued payments decrease in the „No limit Scenario"
  - queue reason „limit exhausted" disappears
  - effect partially offset by increase of queue reason „not enough liquidity"

	1305 basis	1305 without limits	1301 basis	1301 without limits
Process Reasons	618.873	618.873	606.271	606.271
Not enough liquidity	199.848	211.233	241.656	264.783
Bilateral Limit exhausted	41.292		182.663	
Multilateral Limit exhausted	1			
Total	860.014	830.106	1.030.590	871.054

Simulations
Results

Queued Payments with and without limits
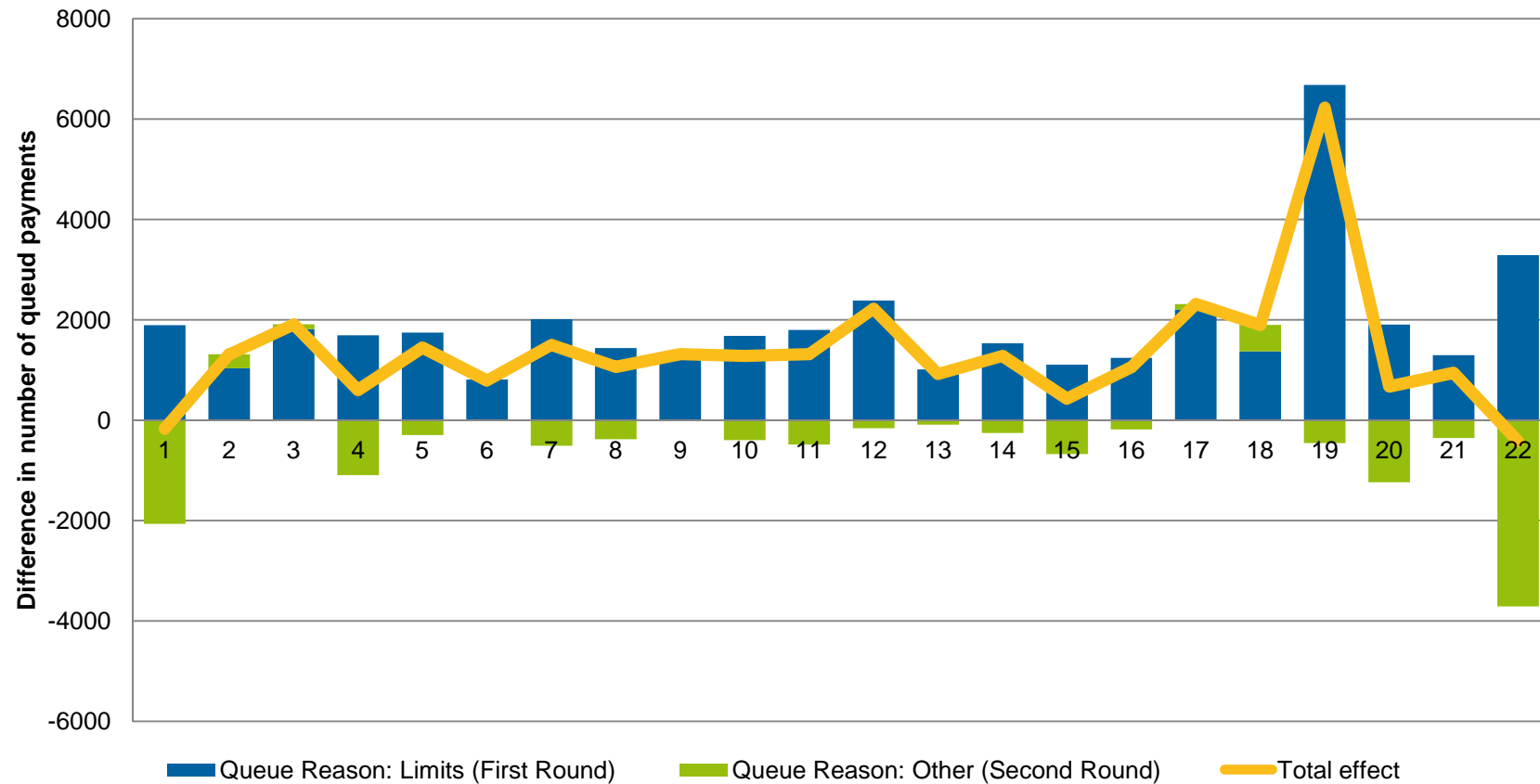
Legend:
- Queue Reason: Limits (First Round)
- Queue Reason: Other (Second Round)
- Total effect

Y-axis: Difference in number of queud payments (−6000 to 8000)
X-axis: 1 to 22

Simulations
## Results

Stress Scenario

– System Level Statistics

- No. of unsettled payments is in general higher compared to basis scenario
- No. of unsettled payments is higher in the „No Limit-Stress Scenario" compared to the stress scenario with limits on average

– Queue Reason Statistics

- Queue reason „limit exhausted" is as frequent as in the basis scenario on average,
- no. of queued payments because of lacking liquidity increases significantly
- multilateral limits are more often exhausted, but still only a few cases
- mixed picture when comparing stress scenario with and without limits

Queued Payments with and without limits in stress scenario
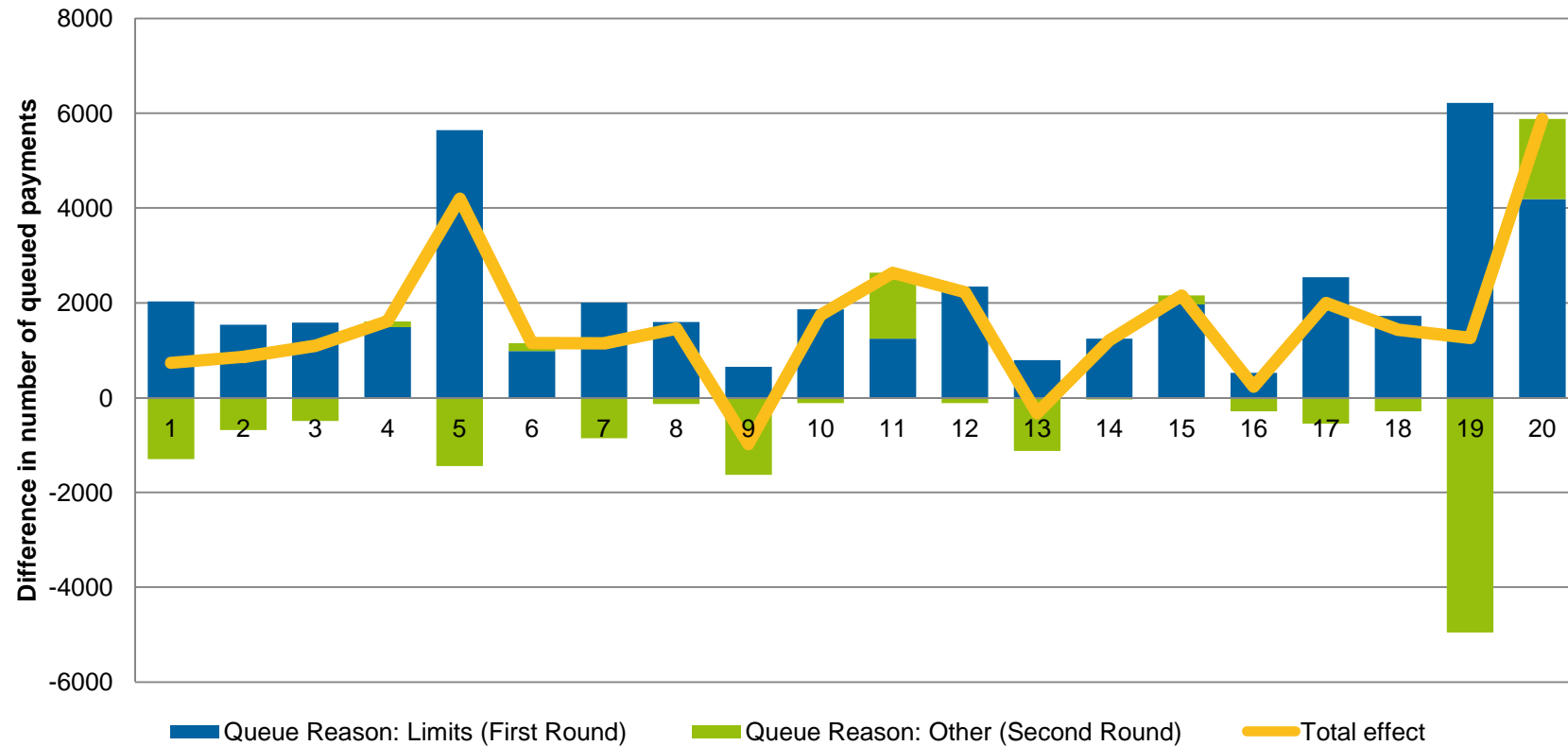
Does limited use of limits limit the use of limits?
Interpretation

Interpretation
Impact of limits

- Limits protect the limit setter against undue outflow of liquidity
  - less outstanding claims
  - restrictions on free-riding by others
- Bilateral limits redirect liquidity to those who pay earlier than others
  ⇒ **limits work as a reward system for early payers**
⇒ **If bilateral limits were to be used widely among all major participants liquidity would be more evenly distributed in the system**
- Limits, especially multilateral limits
  - reduce liquidity-efficiency
  - and decelerate settlement
  - this effect is more pronounced in T2-Simulator than in T2 real (known deviation)
- If limits were too low in comparison to transaction values, settlement could be blocked; empirics:
  - bilateral limits: 25 times as big as average regular payment
  - multilateral limits: 2800 times as big as average regular payment

Does limited use of limits limit the use of limits?
Outlook

Outlook
Next Steps

– Continous monitoring of descriptive indicators

– More detailed analysis of descriptive indicators
  • Analyse changes in the patterns
  • Analyse behaviour of single participants

– Robustness checks of the results

– Additional indicators to compare „No Limit" and „Limit" scenario
  • Settlement delay
  • Liquidity Analysis

– New Stress Scenarios

– Investigate more time periods

– Share results with participants in order to encourage use of bilateral limits

Thank you, for your attention!
Please use the limited time for unlimited questions.