



WHAT KIND OF PAYMENTS SETTLE IN A RTGS SYSTEM?

THE CASE OF NORGES BANK'S SETTLEMENT SYSTEM

17th Annual Simulator Seminar 29-30 August 2019, Helsinki
Mats Bay Fevolden and Lyndsie Smith



Research Paper

What kind of payments settle in a real time gross settlement system? The case of Norges Bank's settlement system (NBO)

Mats Bay Fevolden and Lyndsie Smith

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Results

Conclusion



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Central banks mainly play three roles in the payment system



Operator



Catalyst for change



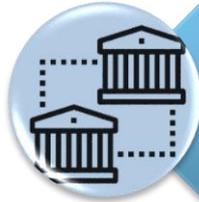
Overseer

Understanding the purpose behind payments are useful for all three roles

Knowledge of payment categorisation has many benefits:



Crisis management



Policy considerations



Observing PFMI



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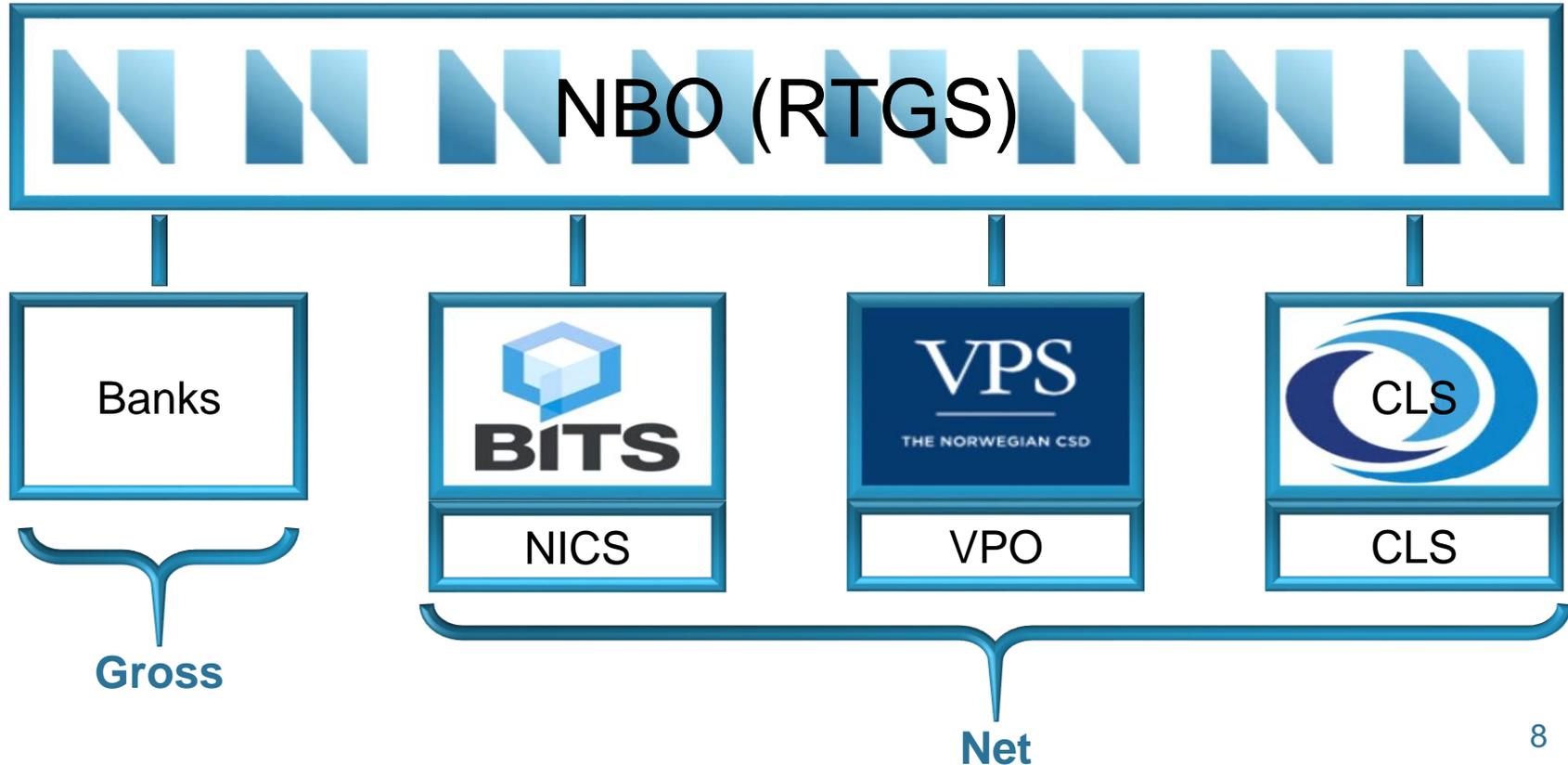
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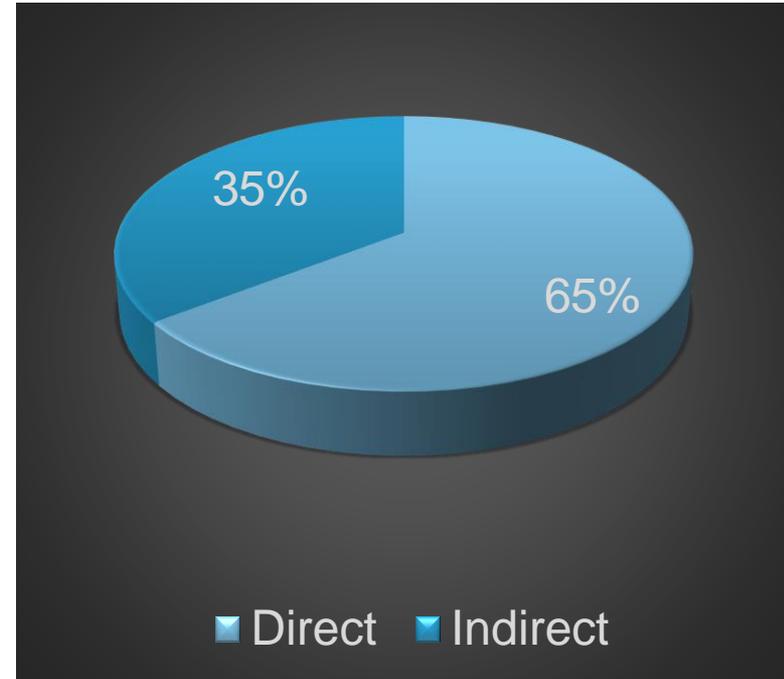
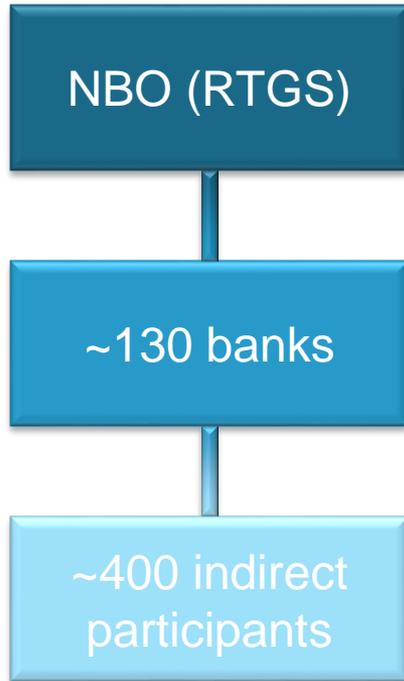
Payments either settle gross or are netted

RTGS and interconnected institutions – gross and net settlement



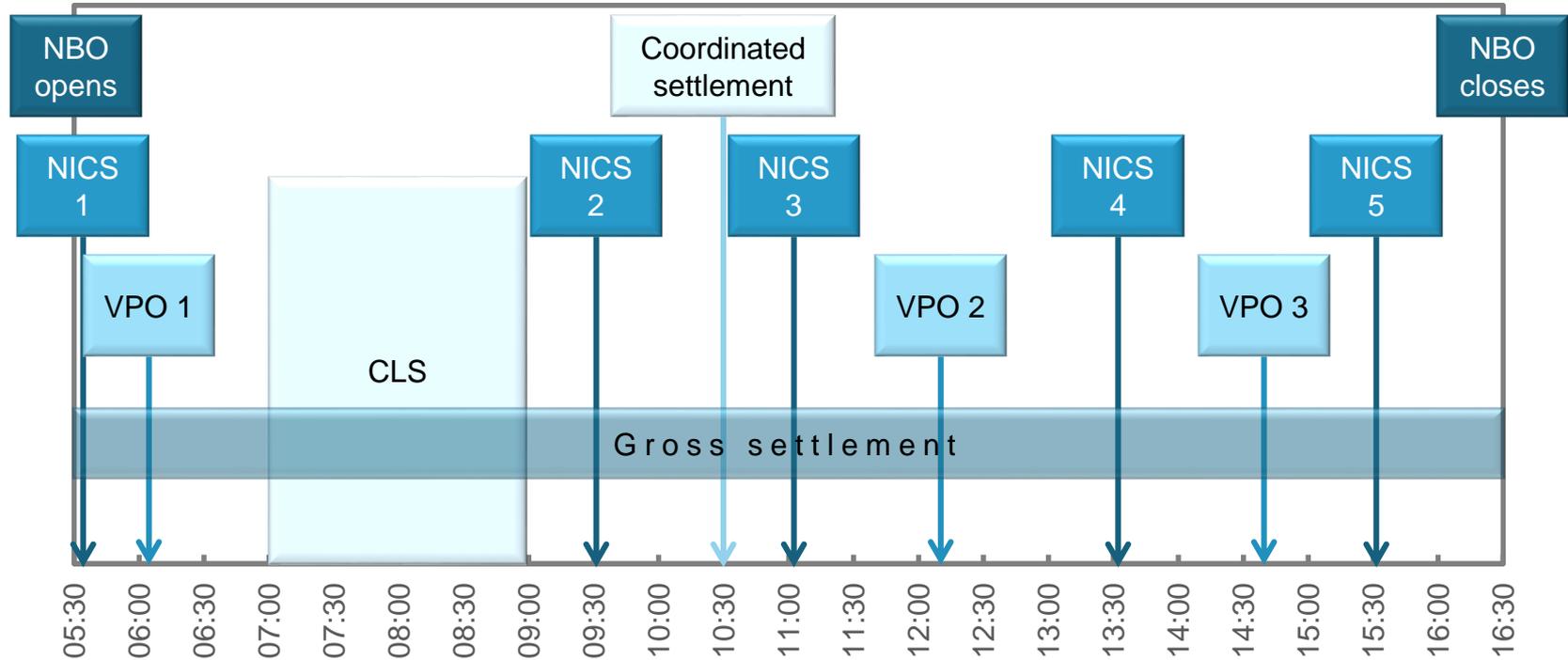
Most payments come from indirect participants

Payment system in Norway



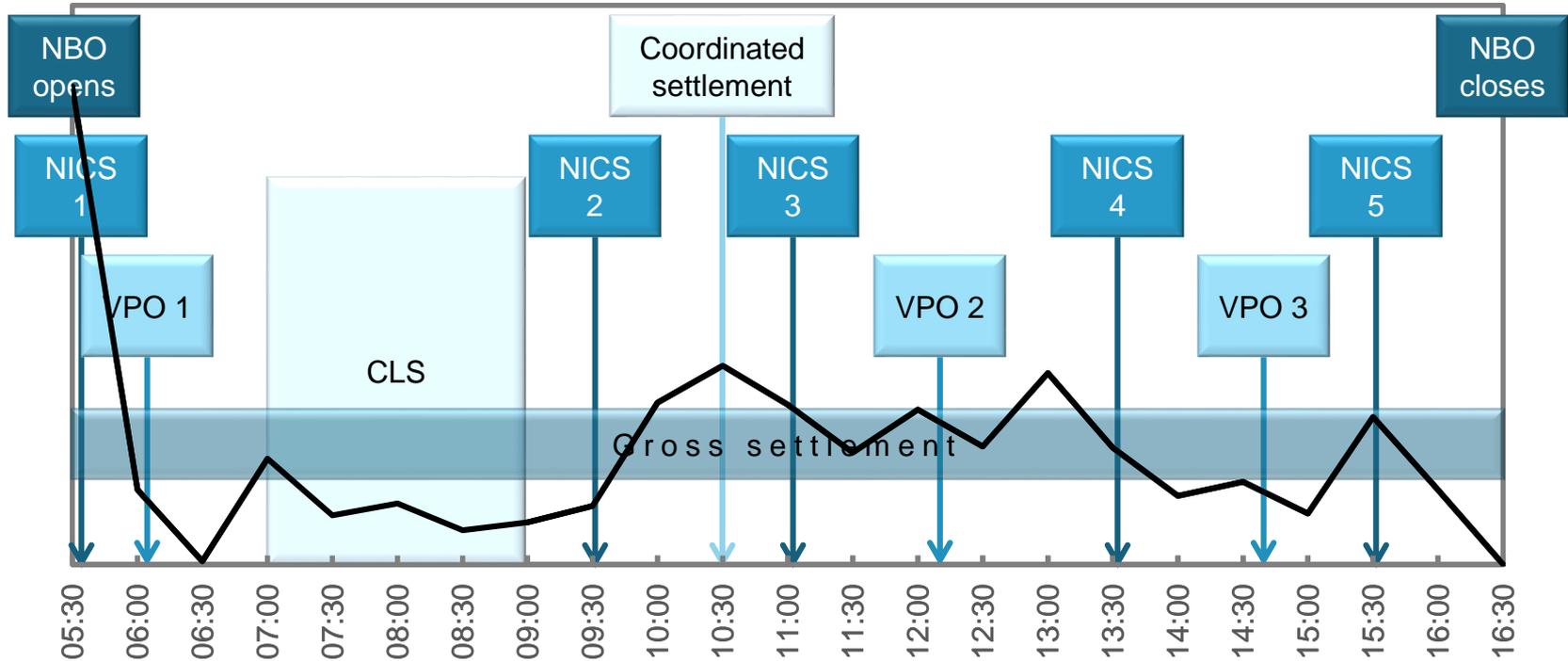
Settlement occurs at fixed times

NBO operating schedule (2019)



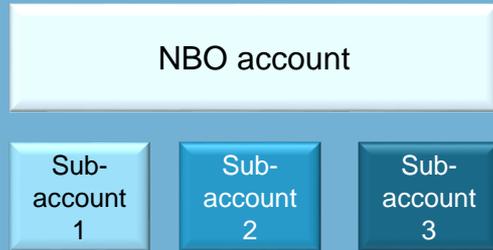
Settlement occurs at fixed times

NBO operating schedule (2019)



Prior to the study we could categorise 21 percent of the turnover by value

Sub-accounts used for net settlement



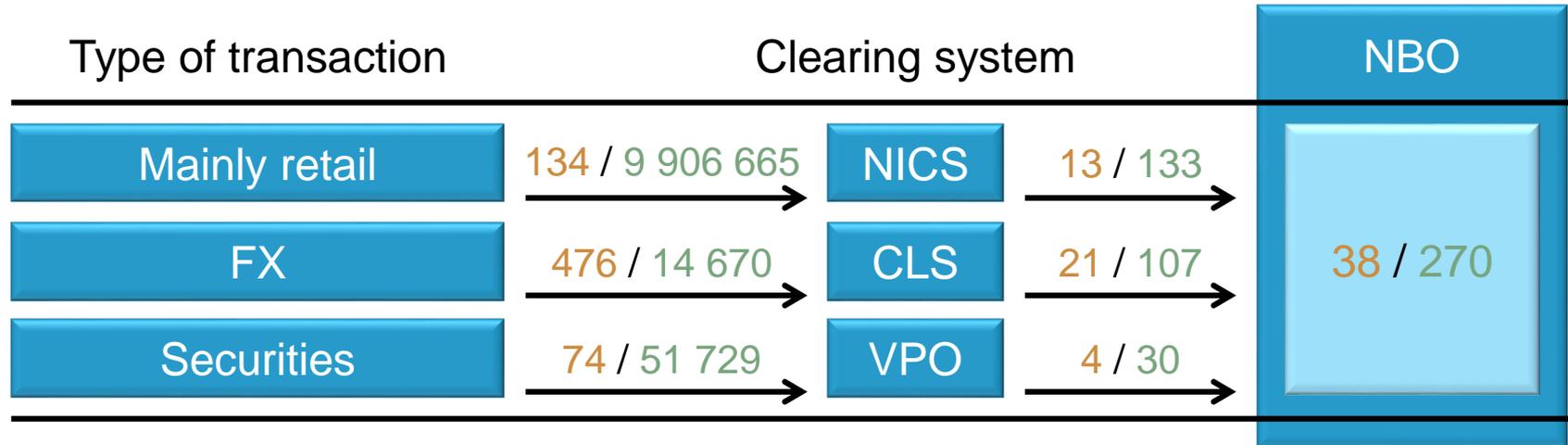
Some gross payments contain a tag



Net settlement makes up ~16 percent of total turnover

Daily average 2017. Total: NOK 240 bn, 1995 transactions.

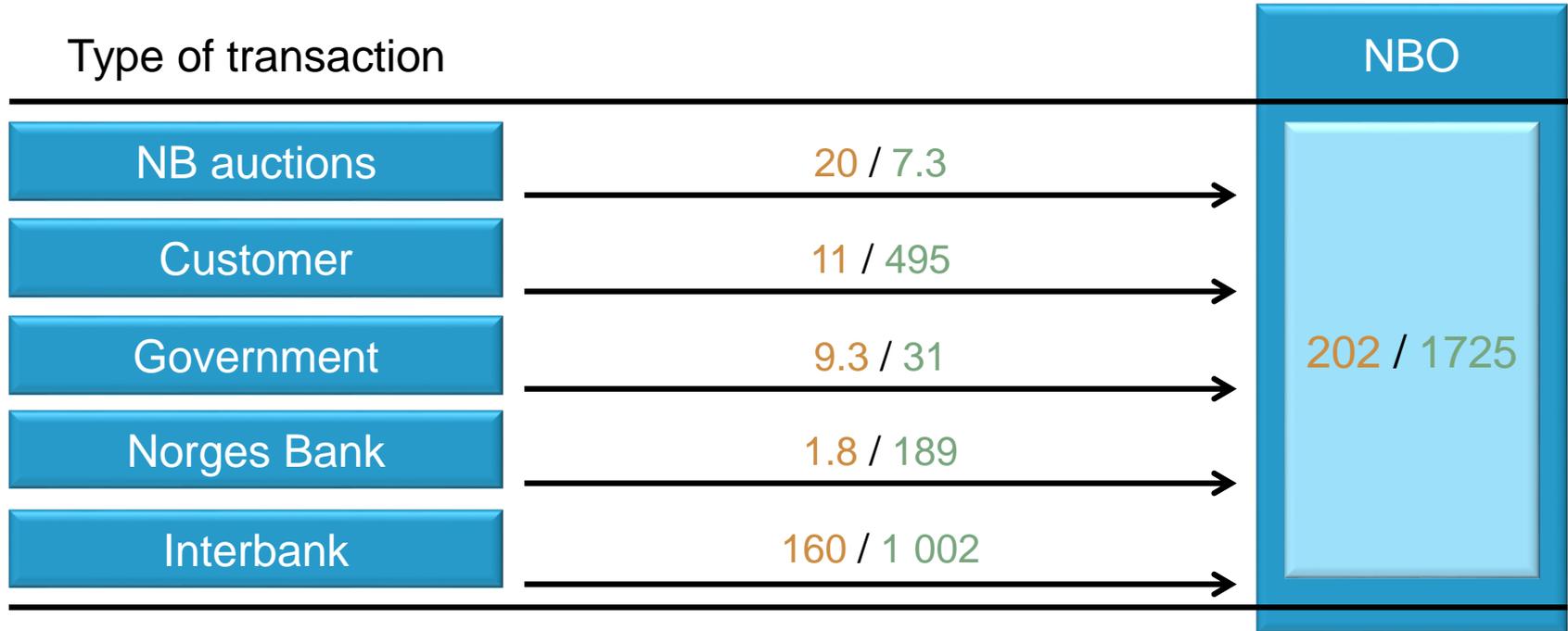
NOK billion / Number of transactions.



Gross settlement- some tagged payments

Daily average 2017. Total: NOK 240 bn, 1995 transactions.

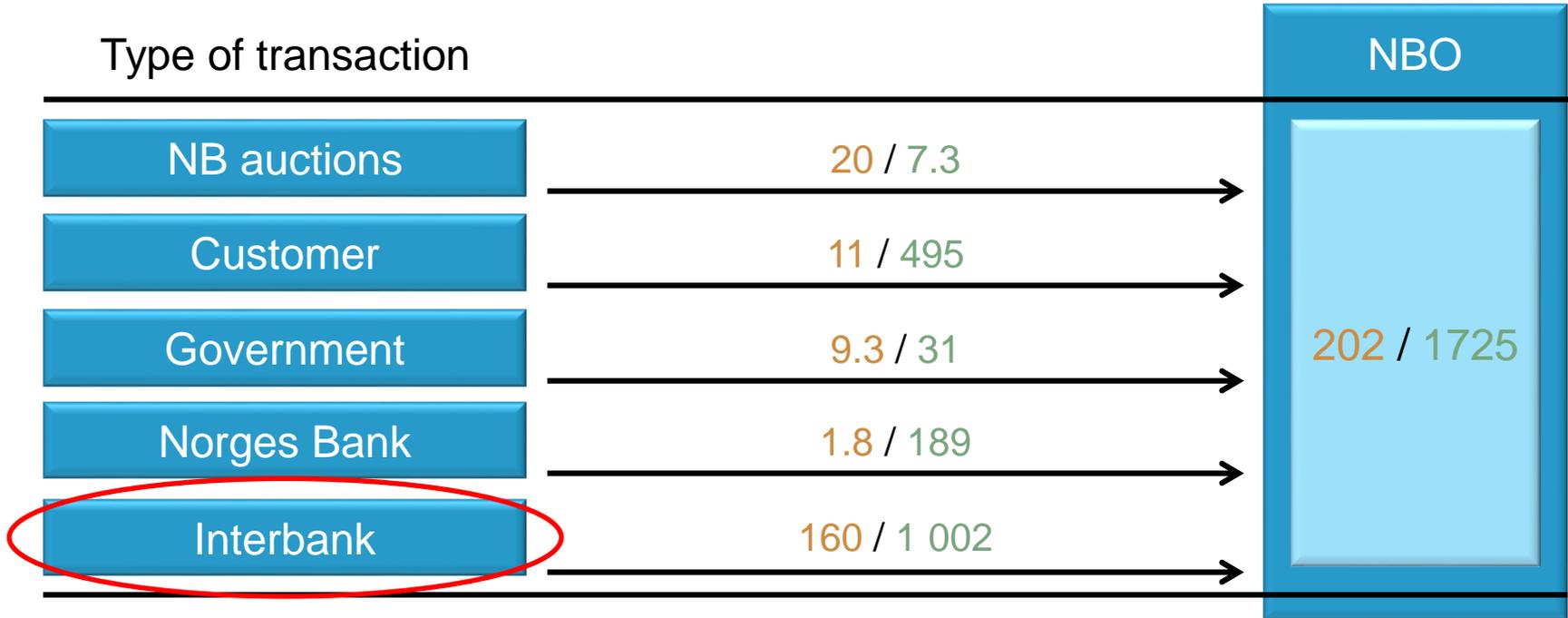
NOK billion / Number of transactions.



Gross settlement- some tagged payments

Daily average 2017. Total: NOK 240 bn, 1995 transactions.

NOK billion / Number of transactions.





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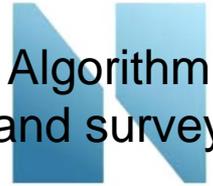
Background

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Hypotheses and the data used to test them

| | | | | |
|--|--|--|--|--|
| Known categories | Customer | FX | Interbank lending | Indirect participants |
|  NBO payment registry |  BITS |  CLS |  Algorithm and survey |  BITS |



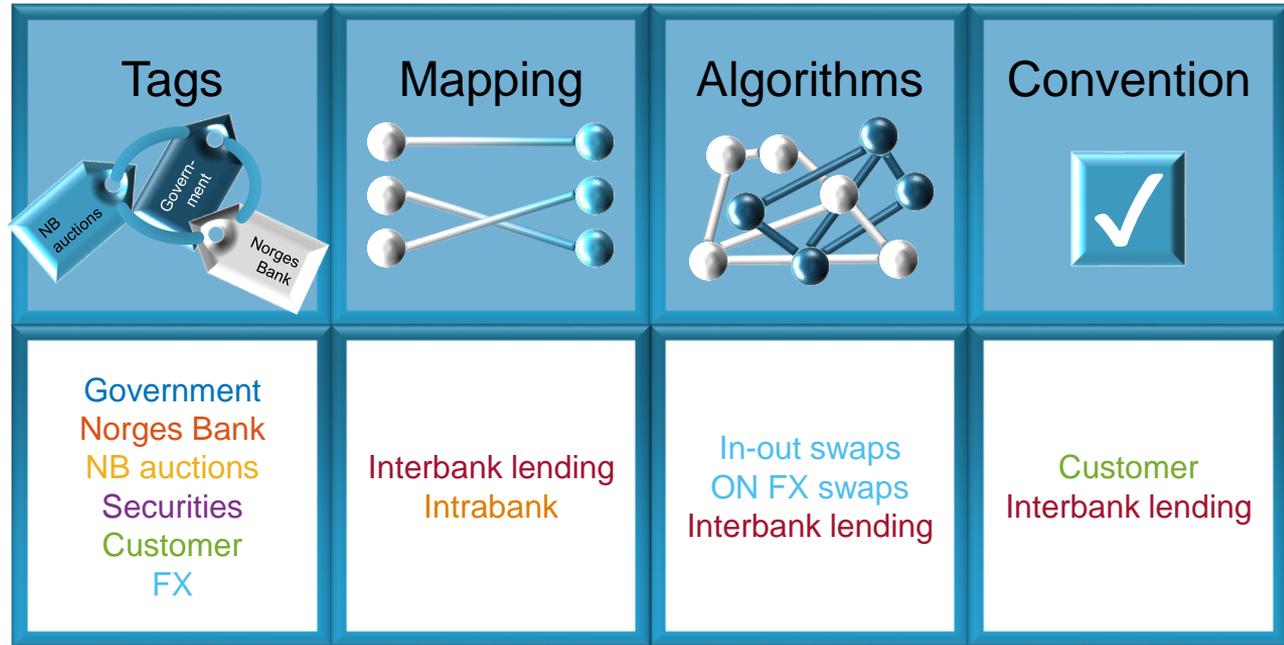
The data sources were varied and non-uniform

| Data | Number of payments | Value (NOK bn.) | Source |
|--------------------------------|---------------------------|------------------------|----------------------|
| Payments settling gross in NBO | 1090 | 171 | NBO payment registry |
| Payments sent to NBO via NICS | 487 | 128 | Bits |
| Interbank loan survey | 21 | 21 | Twenty-three banks |
| CLS settlement data | 355 | 136 | CLS |



The data were utilised in 4 areas to result in 8 categories

- Government
- Norges Bank
- NB auctions
- Securities
- Customer
- FX
- Interbank lending
- Intrabank
- Uncategorised



Identifying interbank loans relies on 10 assumptions

| | | | | |
|------------------------------|---|-----------------------------------|-----------------------------|--|
| Gross interbank payments | Loan: day x Repayment: day x+1 | Loan: A→B Repayment: B→A | Loan: > NOK 1m | Loan: round to NOK 0.1m |
| Rate: round to 0.5 bps | $\text{CBR} - 20 \leq \text{rate} \leq \text{CBR} + 20$ | Rate: Annualised | Rate: 365 or 360 days | Max rounding error: 1/100 NOK |



Identification of interbank loans was tested and found to be reliable

I: Overestimation of overnight loans - Type 1 errors (%)

| Value step (mill) | Minimum loan value (mill) | | |
|-------------------|---------------------------|--------------|-------|
| | 0 | 1 | 10 |
| 0.01 | 1.3 % | 1.3 % | 0.4 % |
| 0.1 | 1.3 % | 1.3 % | 0.4 % |
| 1.0 | 1.3 % | 0.9 % | 0.0 % |
| 10 | 1.3 % | 0.9 % | 0.0 % |

II: Underestimation of overnight loans - Type 2 errors (%)

| Value step (mill) | Minimum loan value (mill) | | |
|-------------------|---------------------------|--------------|--------|
| | 0 | 1 | 10 |
| 0.01 | 0.0 % | 0.0 % | 0.9 % |
| 0.1 | 0.0 % | 0.0 % | 0.9 % |
| 1.0 | 0.4 % | 0.4 % | 1.3 % |
| 10 | 21.1 % | 21.1 % | 21.1 % |

I: Overestimation of overnight loans - Type 1 errors (%)

| Decimal rounding | Bandwidth (bp) | | | |
|------------------|----------------|--------------|-------|-------|
| | ± 5 | ±10 | ±20 | ±50 |
| 0.10 | 0.0 % | 1.3 % | 4.9 % | 4.9 % |
| 0.50 | 0.0 % | 1.3 % | 1.3 % | 1.3 % |
| 1.00 | 0.0 % | 0.9 % | 0.9 % | 0.9 % |

II: Underestimation of overnight loans - Type 2 errors (%)

| Decimal rounding | Bandwidth (bp) | | | |
|------------------|----------------|--------------|-------|-------|
| | ±5 | ±10 | ±20 | ±50 |
| 0.10 | 5.8 % | 0.0 % | 0.0 % | 0.0 % |
| 0.50 | 5.8 % | 0.0 % | 0.0 % | 0.0 % |
| 1.00 | 6.3 % | 0.4 % | 0.4 % | 0.4 % |





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The results show that much of the turnover is now categorised

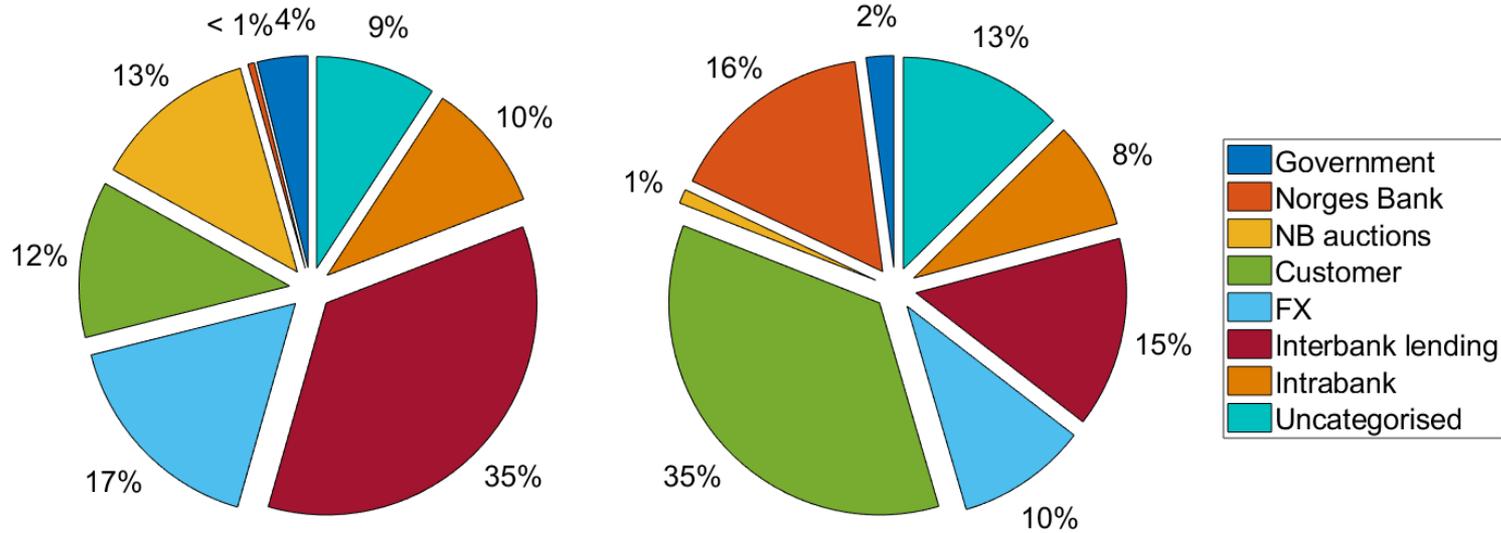
| Payment type | Daily value of payments (NOK bn.) | Daily number of payments | Share of gross value (%) | Share of gross number (%) | Share of total value (%) | Share of total number (%) |
|--|-----------------------------------|--------------------------|--------------------------|---------------------------|--------------------------|---------------------------|
| Government | 6.6 | 23 | 5 | 2 | 3 | 2 |
| Norges Bank | 0.8 | 173 | 0 | 16 | 0 | 13 |
| Norges Bank liquidity management (NB auctions) | 21.5 | 12 | 13 | 1 | 11 | 1 |
| Securities | 3.1 | 34 | — | — | 2 | 3 |
| Customer payments: firms and households | 30.9 [16.9] | 493 [344] | 12 [4] | 35 [27] | 16 [8] | 36 [26] |
| FX | 42.2 [13.8] | 239 [130] | 17 [0] | 10 [0] | 21 [7] | 18 [10] |
| Interbank lending | 60.2 [0] | 159 [0] | 35 [0] | 15 [0] | 30 [0] | 12 [0] |
| Intrabank payments | 16.9 [0] | 90 [0] | 10 [0] | 8 [0] | 9 [0] | 7 [0] |
| Categorized | 154.9 [60.4] | 952 [711] | 91 [21] | 87 [47] | 92 [32] | 90 [55] |
| Uncategorized | 15.8 [137.6] | 138 [582] | 9 [79] | 13 [53] | 8 [68] | 10 [45] |
| Total* | 198 | 1360 | 100 | 100 | 100 | 100 |

Numbers in square brackets indicate the share of categorization prior to this work, when different. *Totals may not equal sum of values in table due to rounding.



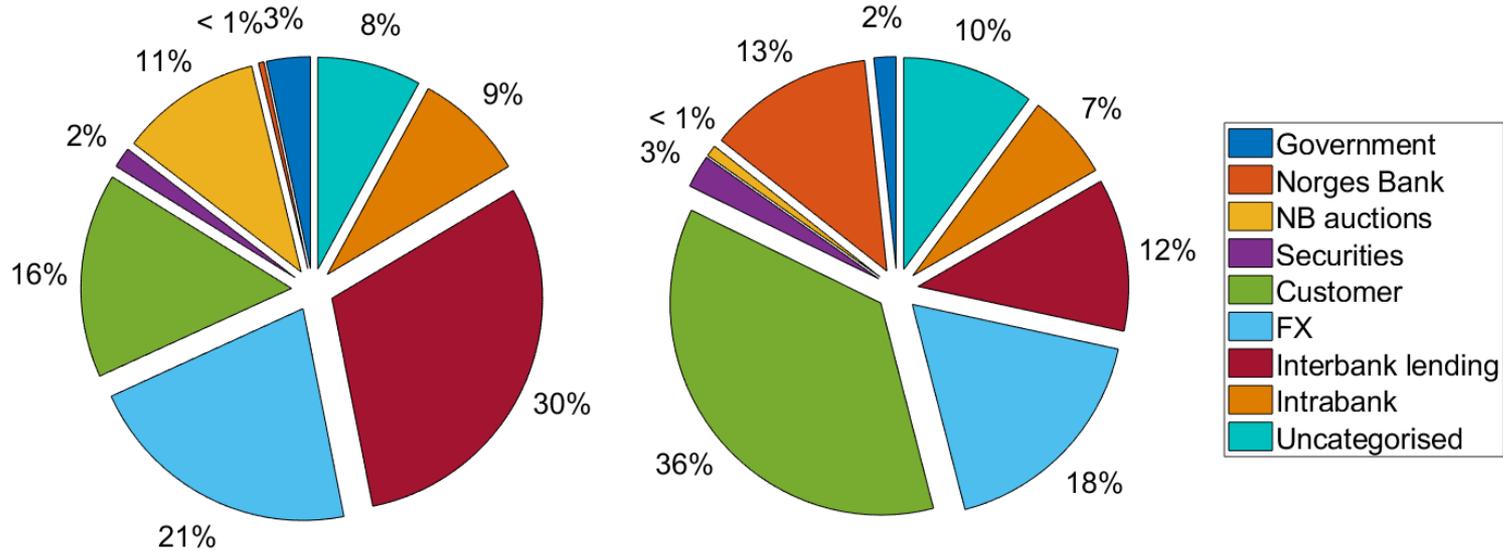
Gross turnover distribution

Left: Value, Right: number of transactions



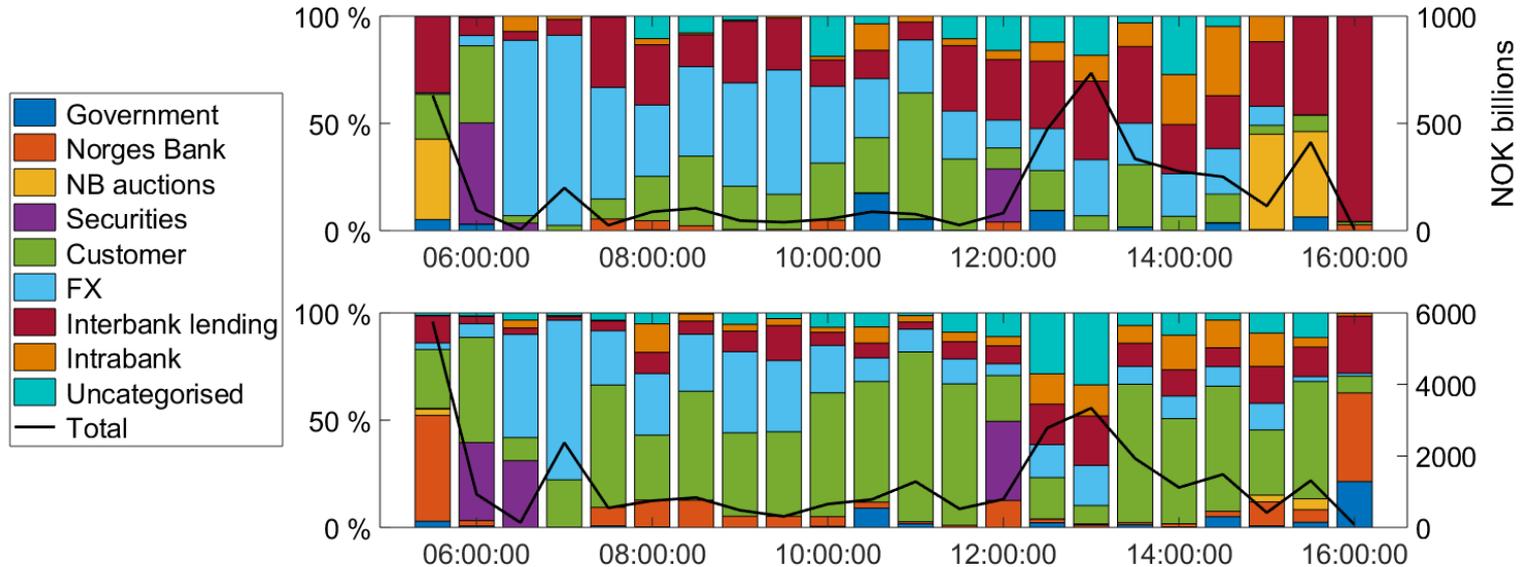
Total turnover distribution

Left: Value, Right: number of transactions



Total turnover intraday

Top: value, Bottom: number





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- ✓ Why? Categorisation of payments has many benefits
- ✓ Which RTGS System? NBO
- ✓ How? Data collection and algorithms
- ✓ What did we achieve? 90% (92%) payments categorised by number (value)