Risks and efficiency gains of a tiered structure in large-value payments: a simulation approach

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Aim of the paper

- **Tiering**
  - Definition
  - Bank interest in tiering – decrease concentration

- **Quantify** risks and benefits of the tiered structure in CHAPS Sterling

- **Simulation approach** increasing the degree of tiering in artificial scenarios

Tiering: risks and benefits

- **Risks**
  - Increases **node risk** (operational failure, liquidity sink)
  - Increases **credit risk** (intraday overdrafts)
  - May increase legal risk due to internalisation
  - Increases in liquidity dependence

- **Benefits**
  - Less dependence of central infrastructure
  - Increase monitoring
  - Economies of scale – infrastructure, fee structure, dedicated liquidity management team, **liquidity recycling** (internalisation and liquidity pooling)

Data limitations

- No data on second-tier banks' transactions
- Complete set of daily transactions by settlement banks – time and value
  - But no information on the nature (own transactions or on behalf of customers) of those transactions
  - Use dataset of settlement banks' transactions to study effects of tiering by increasing concentration (rather than decreasing tiering) – simulation approach

Methodology – simulation approach

- Bank of Finland payment and settlement simulator

- Replicate CHAPS environment

- Establish 'benchmark' against which other scenarios are compared

  - June 2005 data – 22 days worth of data

- 23 different scenarios simulated

Methodology – Assign small banks to major settlement banks
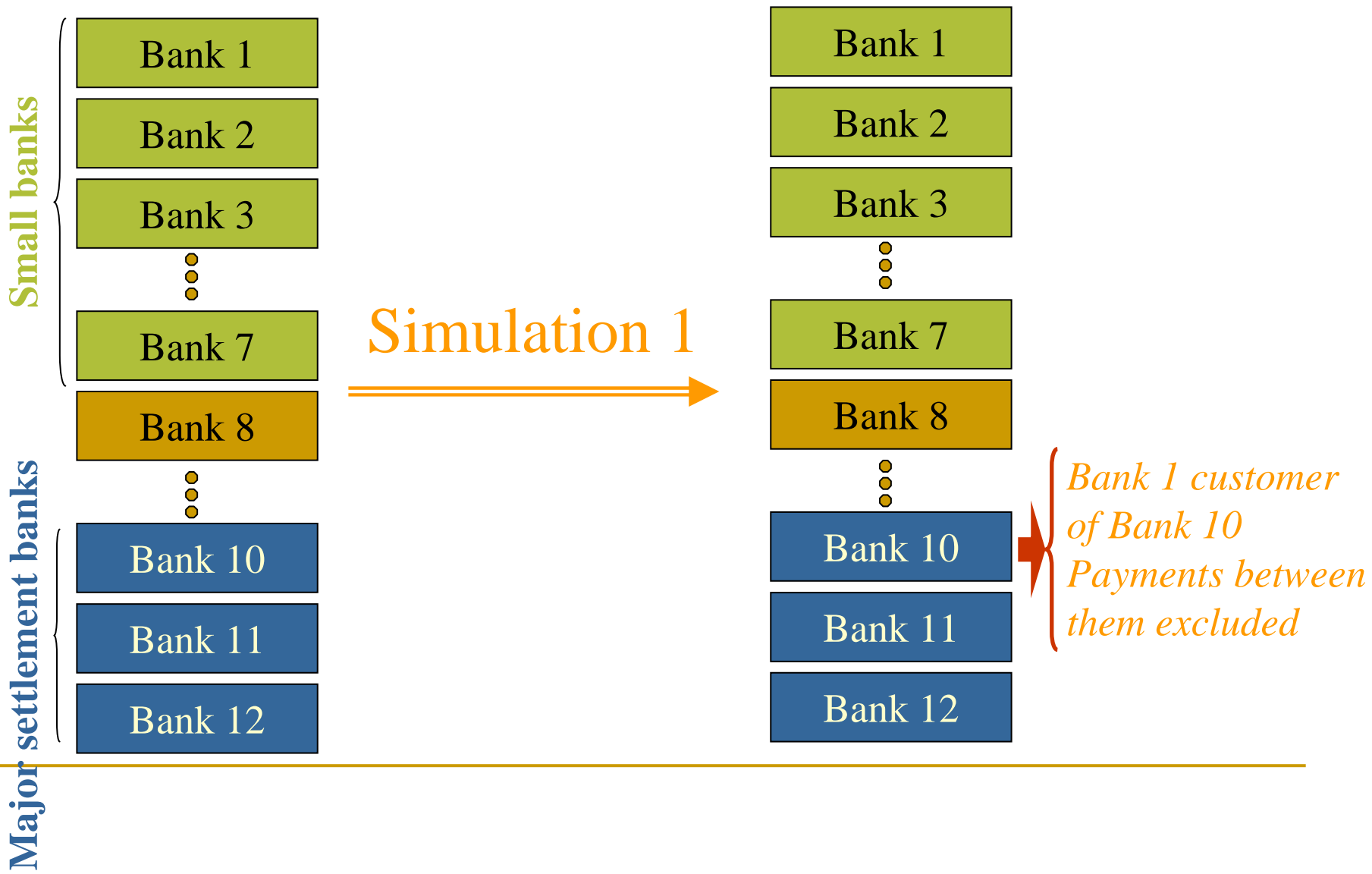
Methodology – Assign small banks to major settlement banks

Simulation 2

Bank 1

Bank 2

Bank 3

Bank 7

Bank 8

Bank 10

Bank 11

Bank 12

Banks 1 and 2 customers of Bank 10
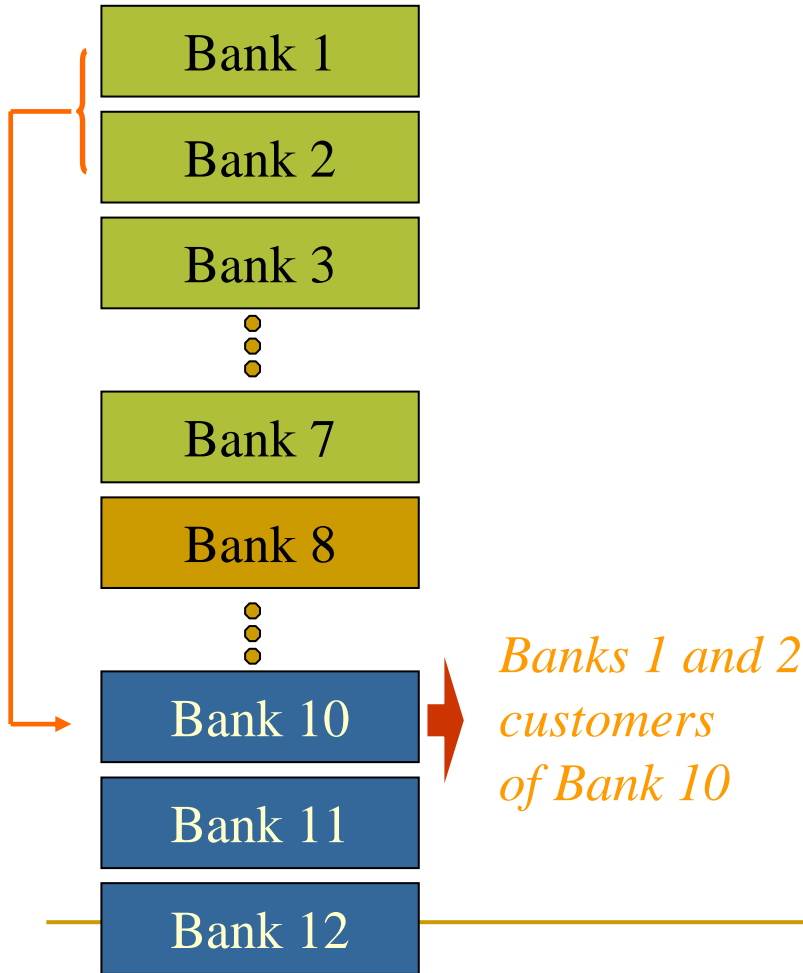
Methodology – Assign small banks to major settlement banks

Simulation 22

| Bank 1 |
| Bank 2 |
| Bank 3 |
| Bank 7 |
| Bank 8 |
| Bank 10 |
| Bank 11 |
| Bank 12 |

Banks 1 to 7 customers of Bank 10 to 12 – according to bilateral payments

Methodology

- Underlying assumptions:
  - Timing of payments stays the same
  - Banks take their customers with them

Results – Efficiency gains (1)

- **Liquidity savings**
  - All savings
  - Liquidity pooling
  - Internalisation

Results – Efficiency gains (2)

Chart 3: Tiering and liquidity usage
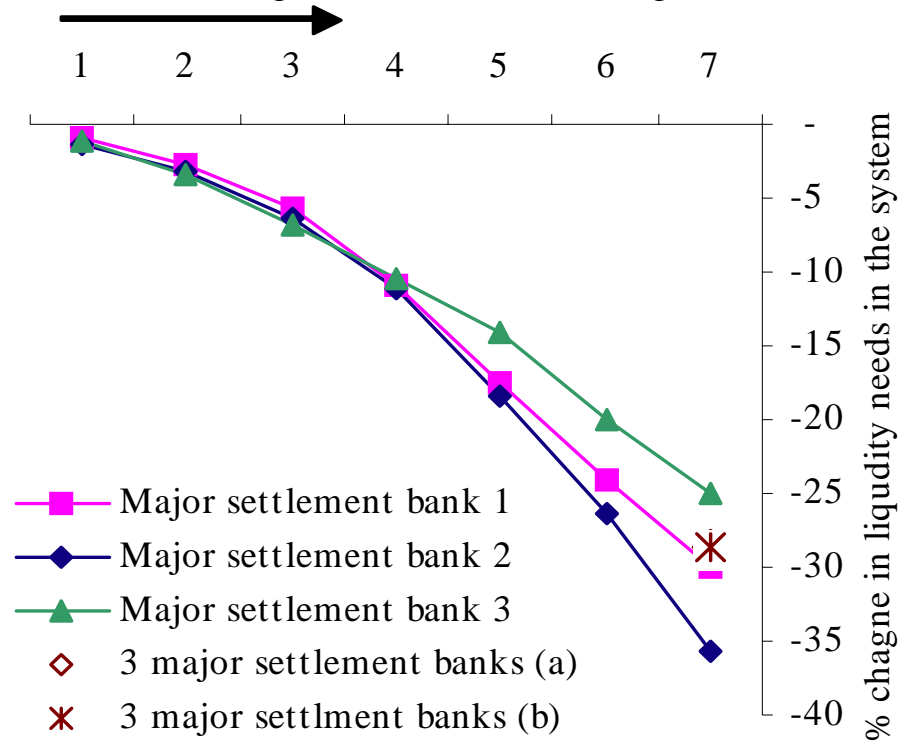
Chart 4: Value settled in CHAPS and liquidity usage
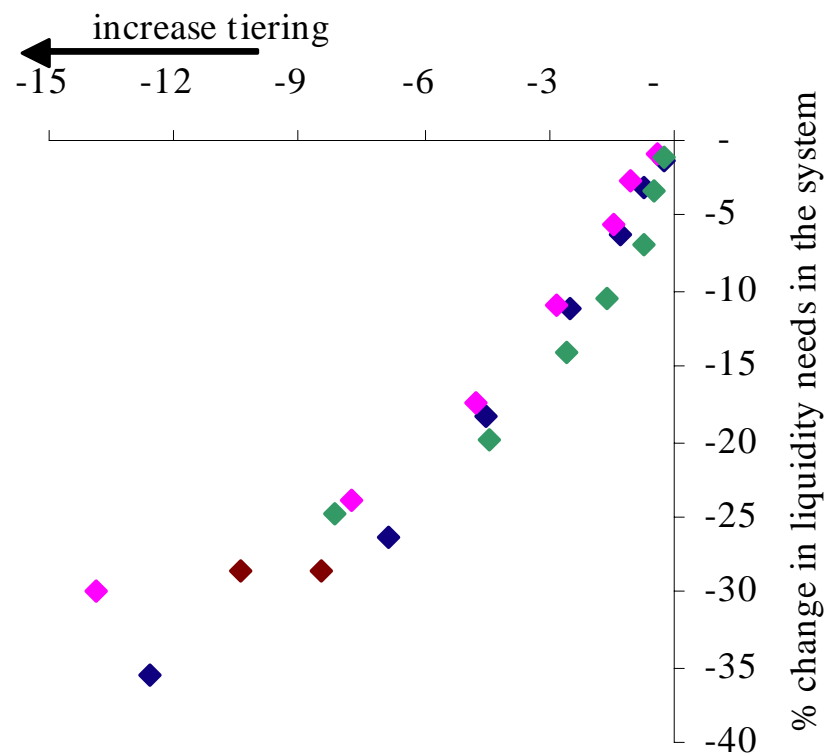
Results – Efficiency gains (3)

- The close relationship between changes in value settled and changes in liquidity needs – allows us to carry out a forecasting exercise

- Interested in: how much liquidity would CHAPS need if some large (by value of payments processed) customer banks became settlement banks

- How to forecast? we need to make assumptions about the functional form that relate changes in values and liquidity

Results – Efficiency gains (4)

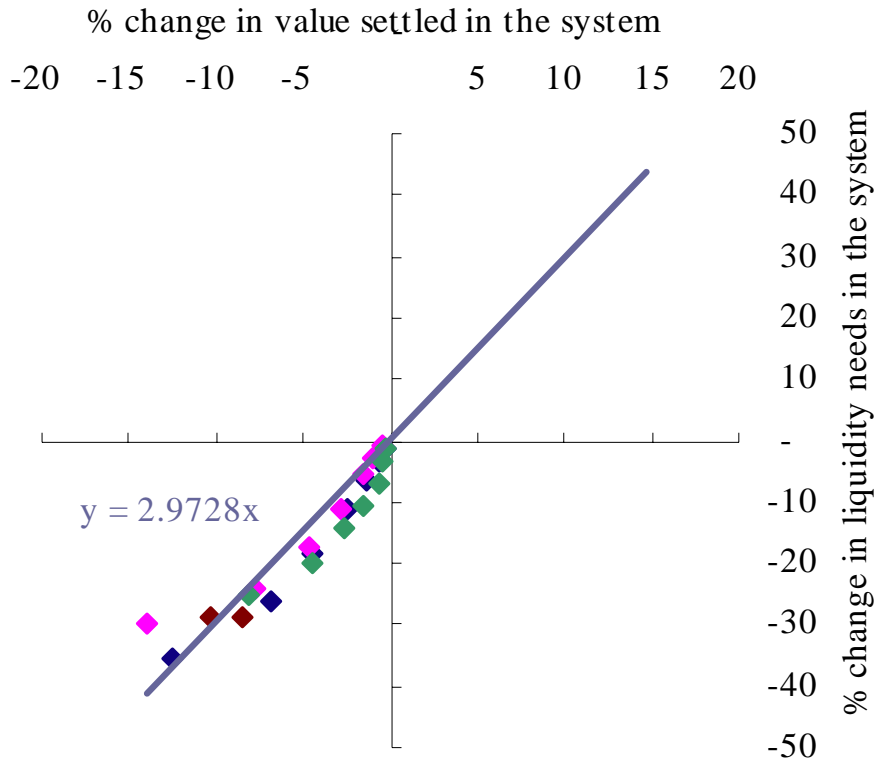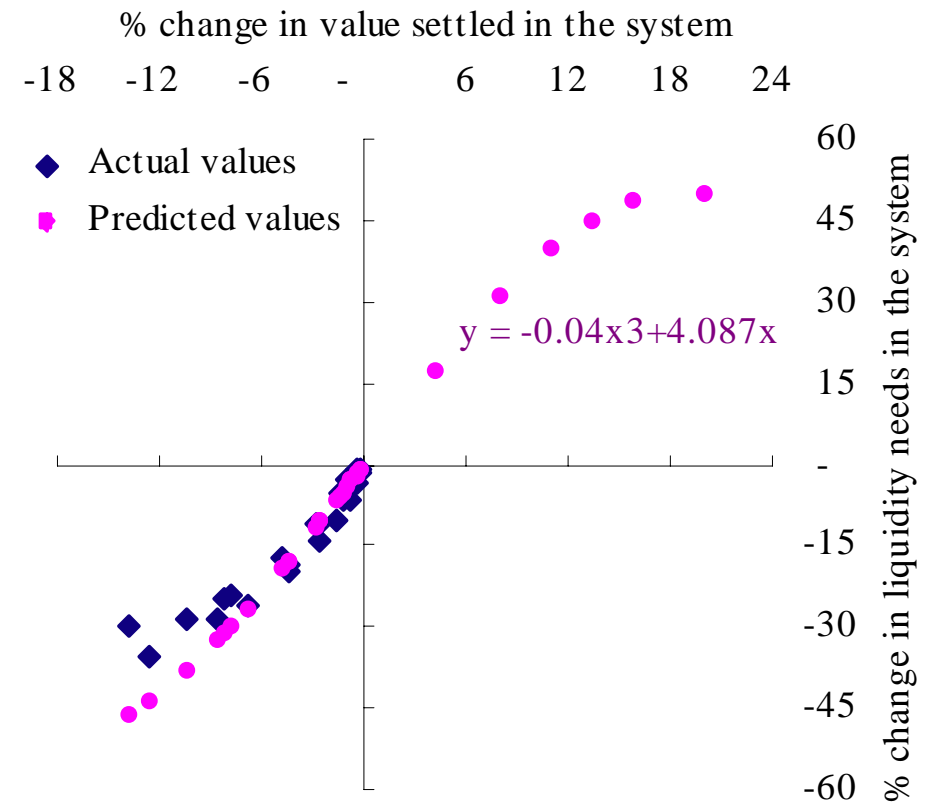**Chart 5: Predicted changes in liquidity needs based on changes in value settled – linear relationship**

Chart 6: Predicted changes in liquidity needs based on changes in value settled – cubic relationship

% change in value settled in the system

$y = 2.9728x$

% change in liquidity needs in the system

% change in value settled in the system

◆ Actual values

◆ Predicted values

$y = -0.04x3 + 4.087x$

% change in liquidity needs in the system

Liquidity saving calculations (based on simulations)

Benchmark — **Benchmark excluding** payments between new customers and their correspondent banks = **Maximum** liquidity savings from **internalisation**

Benchmark — **More concentrated scenario but payments** between new customers and their correspondent banks **sent to RTGS** = **Maximum** liquidity savings from **liquidity pooling**

More concentrated scenario but payments between new customers and their correspondent banks **sent to RTGS** — **More concentrated scenario** = **Minimum** liquidity savings from **internalisation**

Benchmark excluding payments between new customers and their correspondent banks — **More concentrated scenario** = **Minimum** liquidity savings from **liquidity pooling**

Liquidity saving calculations – example for one scenario

Maximum liquidity savings due to internalisation

Minimum liquidity savings due to liquidity pooling

Minimum liquidity savings due to internalisation

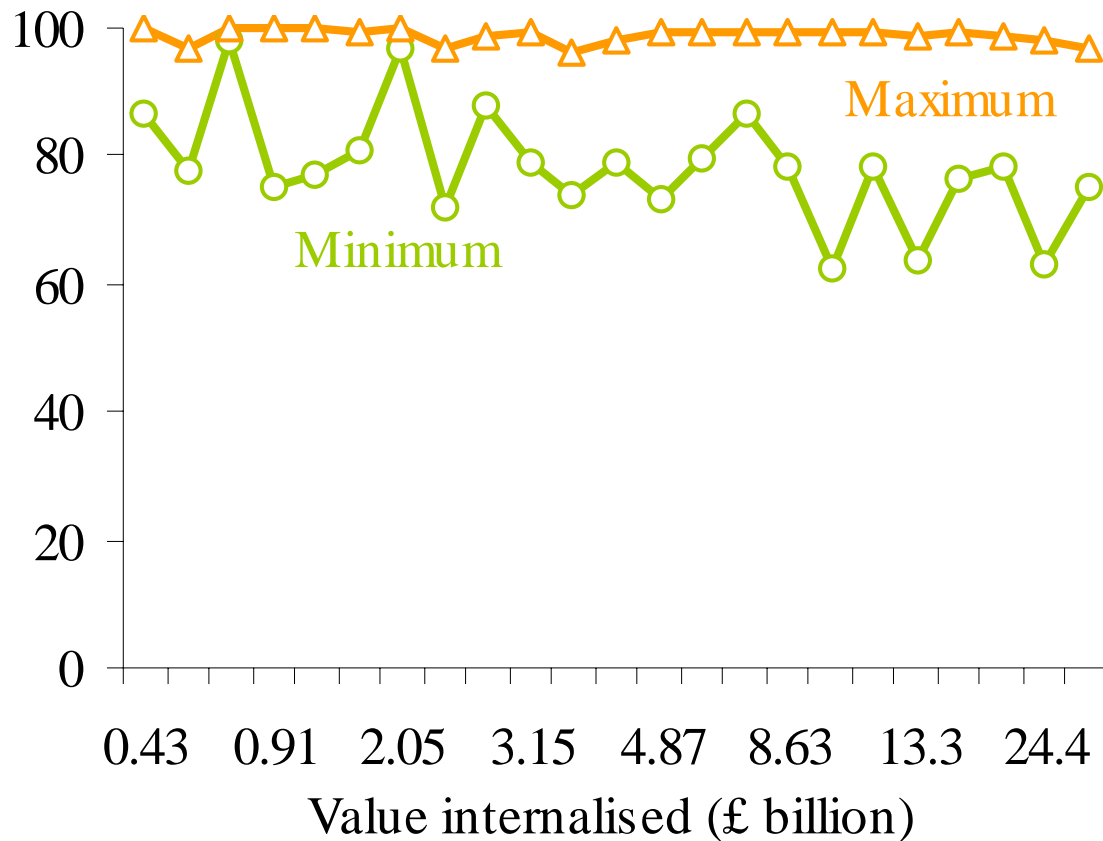Maximum liquidity savings due to liquidity pooling

0

100
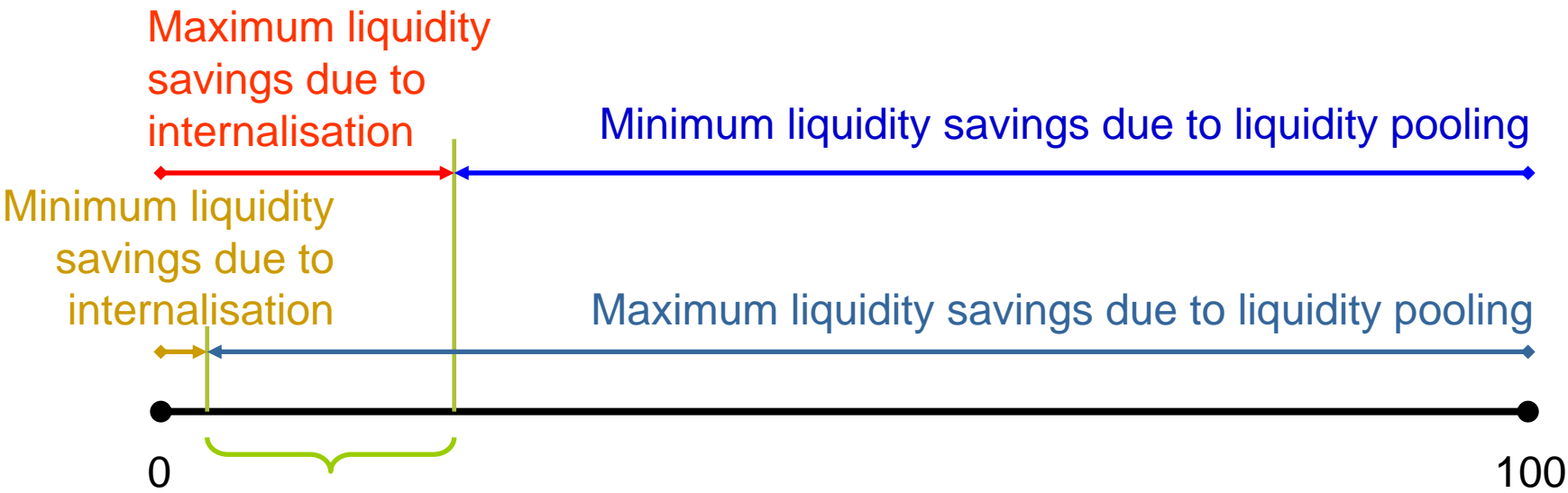
Double counting of liquidity savings
? Timing of payments –
liquidity savings only possible once

~ 20%

Liquidity savings from liquidity pooling

Per cent of liquidity savings
due to liquidity pooling

Conclusions

- Substantial liquidity savings: not very relevant now, it could be if regulatory framework changed.

- If tiering decreased: at the system level extra liquidity requirements would still be small compared to spare liquidity (this conclusion might not hold for individual banks).

- Most of liquidity savings come from liquidity pooling (rather than internalisation), and

- There is not clear relationship between decrease in value settled and proportion of liquidity savings due to liquidity pooling.

Thank you for listening!