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Determinants of tiering in payment systems

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Overview

- Motivation
- Literature on tiering, explanations of its emergence
- A model of tiering
- Some evidence

Motivation I: Tiering patterns differ widely across countries – and types of system

Tiering in different countries – data from 2003

Country	System name	No. of settlement banks[a]	No. of credit institutions
United Kingdom	CHAPS Sterling	13	420
	CHAPS Euro	19	
Belgium	ELLIPS	16	109
Canada	LVTS	14	45
France	TBF	156	1,067
	PNS	21	
Germany	RTGS Plus	93	2,370
Italy	BIREL	204	821
Japan	BOJ-NET	371	506
Netherlands	TOP	106	95
Sweden	E-RIX	13	125
	K-RIX	19	
Switzerland	SIC	307	327
United States	Fedwire	7,736	8,130
	CHIPS		Not available
European Union	TARGET	1,579	–
	Euro1		

Source: Lasaosa and Tudela (2008)

Motivation II: Recent concerns voiced about tiering

- Lessons from financial crisis
  - Lehman case highlights risks of tiering

- Bank of England officials make case for a less tiered structure
  - Speeches by Salmon (2011, 2012)

- Excerpt from Salmon (2012):

  ”Going forward, authorities are likely to pay more attention to the degree and riskiness of tiering when forming views on the robustness of the key payment systems they oversee.”

Motivation III: CPSS/IOSCO principle on tiering

Principle 19:

”An FMI should identify, monitor, and manage the material risks to the FMI arising from tiered participation arrangements.”

Some related literature

Explanations emphasizing credit risk

Mostly theoretical literature

Kahn and Roberds (2009) emphasize how trade-off between posting collateral and using system of delegated monitoring can result in tiering.

Jackson and Manning (2007) pursue similar explanation, but also consider other factors such as internalisation effect.

Chapman, Chiu and Molico (2008) examine welfare consequences of clearing agent failure.

Liquidity risk and other factors

Largely empirical literature

Lasaosa and Tudela (2008) and Adams, Galbiate and Giansante (2010) examine the potential liquidity / collateral savings from pooling of payments (internalisation effect).

Concerns about too-big-to-fail problem, see e.g. Stern and Feldman (2004).

Credit risk explanations

- Salmon (2012) explains issue:
  - ”[CHAPS] is a real-time gross settlement system, so intra-day credit risk is eliminated between direct participants. But typically that is not true for relations between the direct members of CHAPS and their customers: unsecured credit is provided during the working day from one party to other, depending on whether the customer has received or made net payments, with positions cleared at the end of the day. This can increase the scope for a problem in one bank to affect others.”
- Explanations in literature - e.g. Kahn and Roberds (2009) – emphasize that use of collateral for effecting payments may be inefficient mechanism

Amplification mechanisms

- Chris Salmon

  ” In a period of stress, one party’s attitude towards the credit risk inherent in the clearing relationship may change. […] In extremis, it might choose to remove those clearing services altogether, but even in less extreme scenarios it may demand more protections in order to carry on clearing for the customer bank. Most obviously, the clearer could ask it to start collateralising its intra-day exposures. From the customer bank’s perspective, the consequence would be to make an already bad situation worse, complicating its recovery situation. Precisely this type of dynamic played out for Lehman Brothers…”

Liquidity risk and other factors

- From perspective of system participants, it may be cheaper (efficient) to use services of direct settlement member
  - Lower liquidity needs due to internalization / netting effect: Transactions between indirect and direct participant can be settled directly on books of direct participant
  - Fixed costs associated with membership
    - Direct membership costs
    - Back-office costs
    - Etc.

Settlement delays

- Delay costs discussed in e.g. Bech and Garratt (2003)
  - One contribution of this paper is to introduce delay costs in evaluation of tiering structures
- Tiering creates dependencies
  - A direct member's inability to settle payments affects indirect members
  - Possibility of contagion

Model

- Paper presents a model in which some entities, ”small banks”, decide whether to become direct or indirect members of payment system

- Rather simple setup
  - Mainly intended as tool for thinking about the determinants of tiering patterns in payment systems

Model set-up

Small banks

- *k* small, heterogeneous banks
- Minimize private costs of participation in payment system
- Choose either to use services of large bank or connect directly to system

Large banks

- 1 large bank
- Offers clearing services to small banks
- Market power determines mark-up

System owner

- Faces costs associated with production of payments
- Sets transaction prices to minimize social cost function

Some features of basic model

- Small banks
  - each have transaction volume $1/k$
  - are located at distances $1/k, 2/k, \ldots,$ 1, from large bank and face associated distance cost (heterogeniety)
  - default with probability q and pay delay cost in case of default
  - face choice between paying direct transaction price and membership fee to system owner or indirect transaction price to large bank
- Large banks
  - default with probability p
- System owner
  - faces costs per transaction and per member

Solving model

- It can be shown that optimal number of indirect participants, j, is integer in interval:

$$\frac{-C_{dist} + kP_{dmem} + (q-p)C_{delay}}{2C_{dist}} \leq j \leq \frac{C_{dist} + kP_{dmem} + (q-p)C_{delay}}{2C_{dist}}$$

- If large bank is monopolist, optimal membership price is:

$$P_{dmem} = 2C_{mem} - \frac{(p-q)}{k} C_{delay}$$

Model with spillover effects

- Probability of indirect participant failing to settle, *q*, is higher if direct participant fails to settle
- Moreover, probability increase with size of large participant and thereby with *j*, number of direct participants
- Optimal *j* with spillover effects:

$$j = \frac{kC_{mem} + (q-p)C_{delay}}{C_{dist}} - \frac{p(q-f(j))C_{delay} + f'(j)\,p(k-j)C_{delay}}{C_{dist}}$$

Net settlement systems

- Failure of any one participant has larger spillover effect
  - In some systems settlement algorithm is of ”all-or-nothing” type

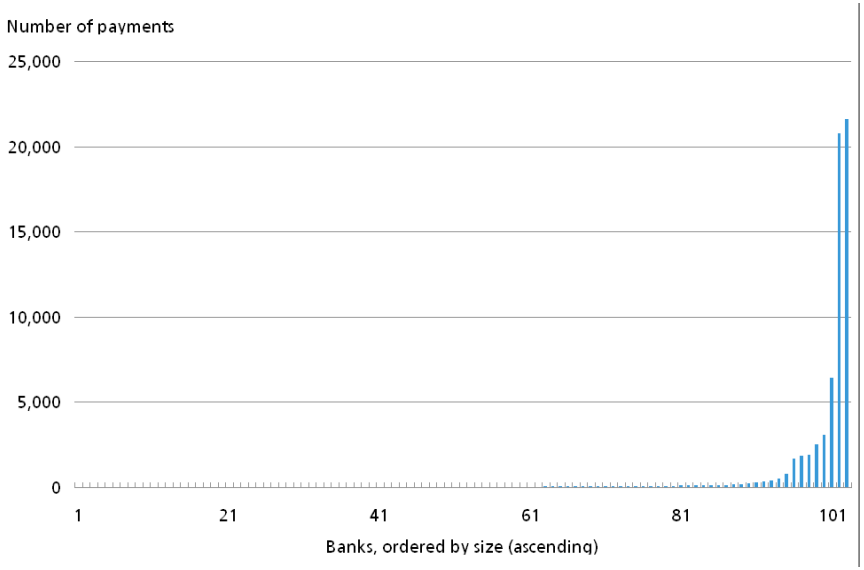
- Model shows
  - Marginal social cost of direct membership higher in net settlement system than in gross settlement system for realistic parameter values
    - Cost in net case: $Cmem + q(1-p)(1-q)^{k-j}Cdelay – jCdist$
    - Cost in gross case: $Cmem + (q-p)/kCdelay – jCdist$
  - Members themselves do not necessarily have greater incentive to choose indirect membership

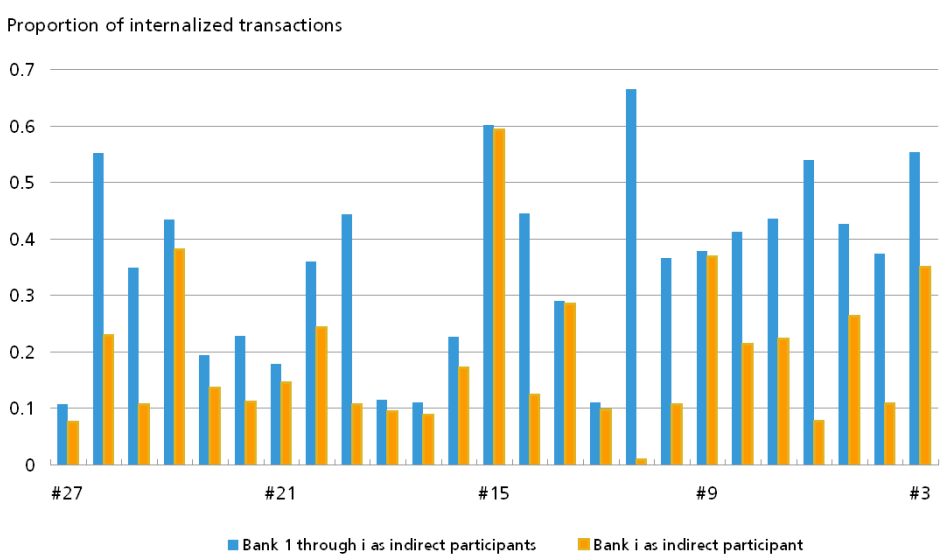
- Policy implication: More stringent membership criteria should be applied in net settlement systems

Some empirical evidence

- How important are different determinants of tiering in practice?
  - Internalization
  - Credit risk
  - Spillover effects
- Examples using May 2012 data from Danish RTGS system and system of settlement of retail payments (net)

Internalization, RTGS





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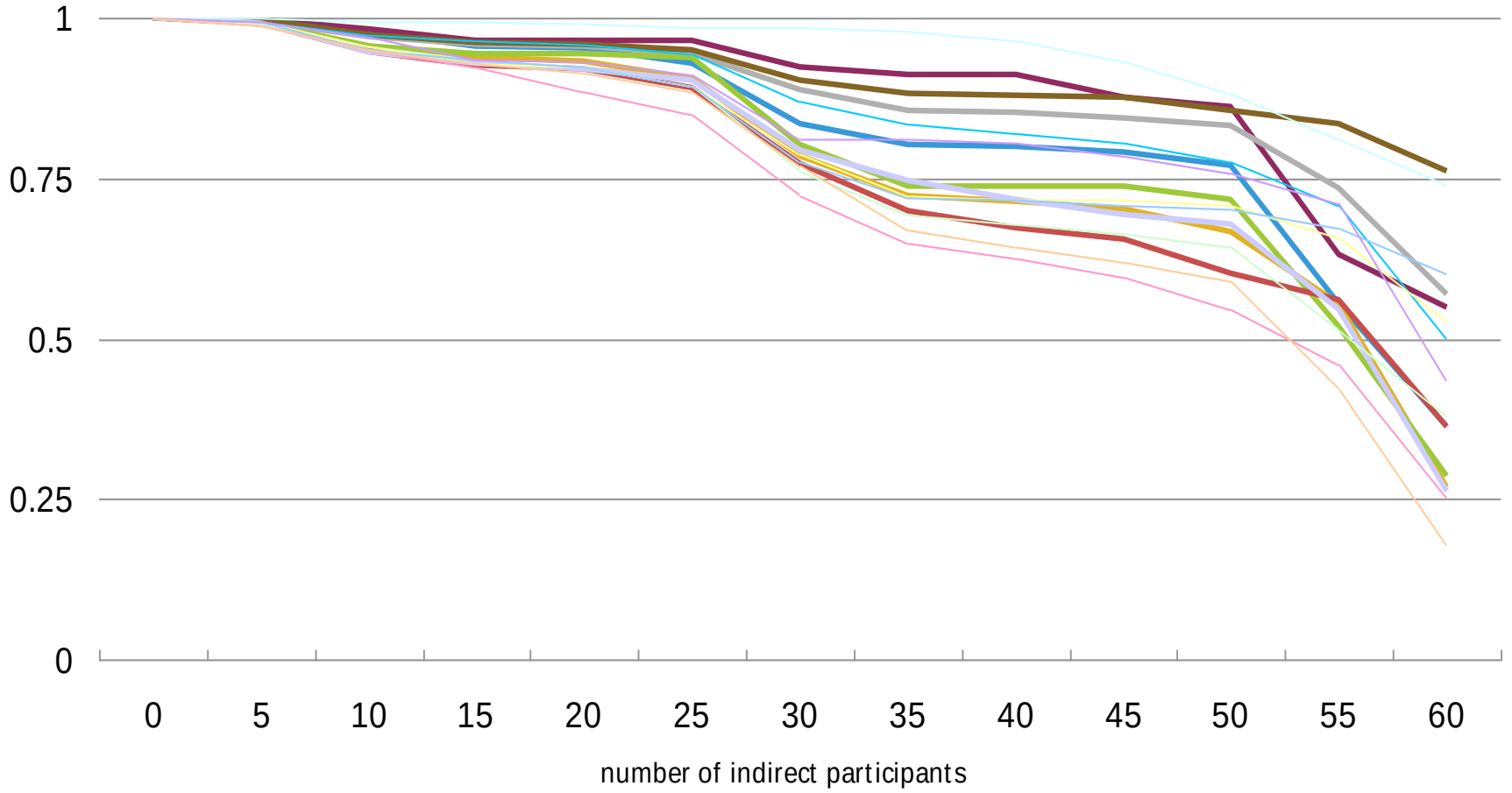
Internalization, DNS



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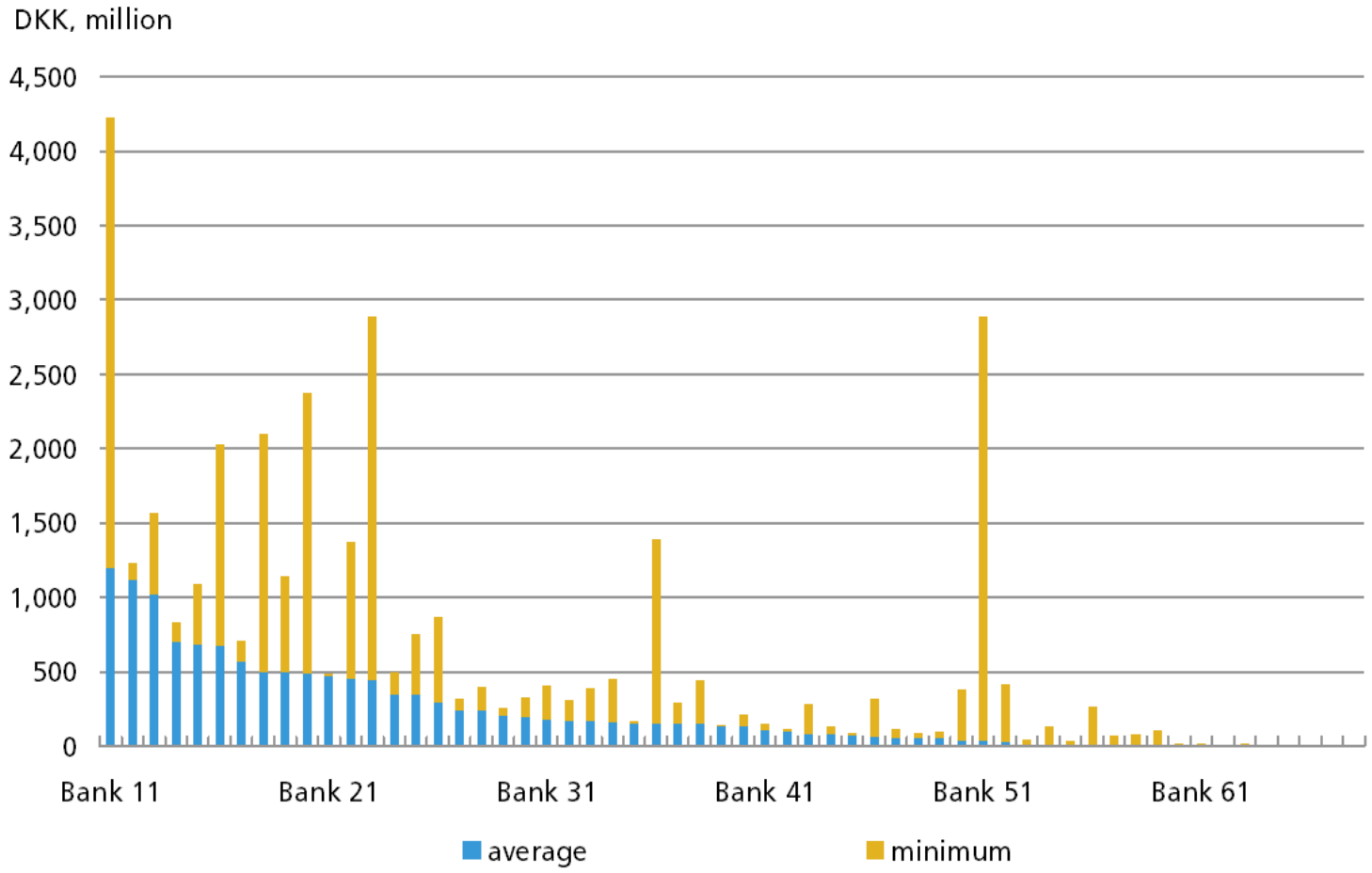
Costs of delay

- Hard to observe!
- Studies of intraday liquidity costs suggestive of costs of delays for banks (~ opportunity cost of collateral), typically between 0-5 bps per hour of delay
  - Requires very large settlement volumes to be important factor!
- Value of immediacy to end-clients could be fairly high
  - Prices paid by corporates for real-time settlement of transactions appear to be quite high in Denmark

Credit risk – fairly large potential exposures due to intraday liquidity needs



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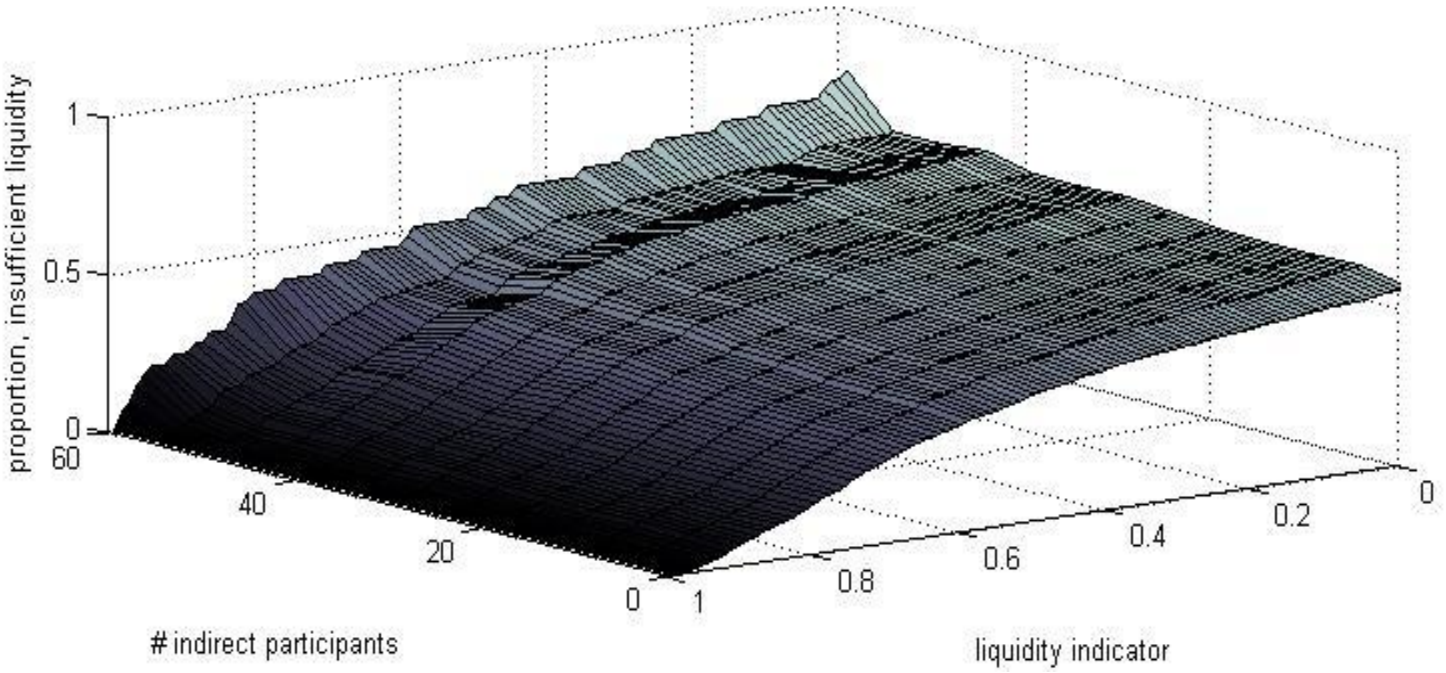
Spillover effects



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Summary

- Tiering patterns reflects various factors: efficiency, internalisation, credit risk and spillover, delay costs, etc.
- Model presented in paper provides tool for thinking about effects of these factors
- Some suggestive empirical evidence
  - Higher degree of tiering in net settlement systems and systems with higher costs of delay (e.g. CLS)
  - In Danish systems, credit risk considerations seem likely to be the more important determinant of (low degree of) tiering