Internet Banking and Market Structure

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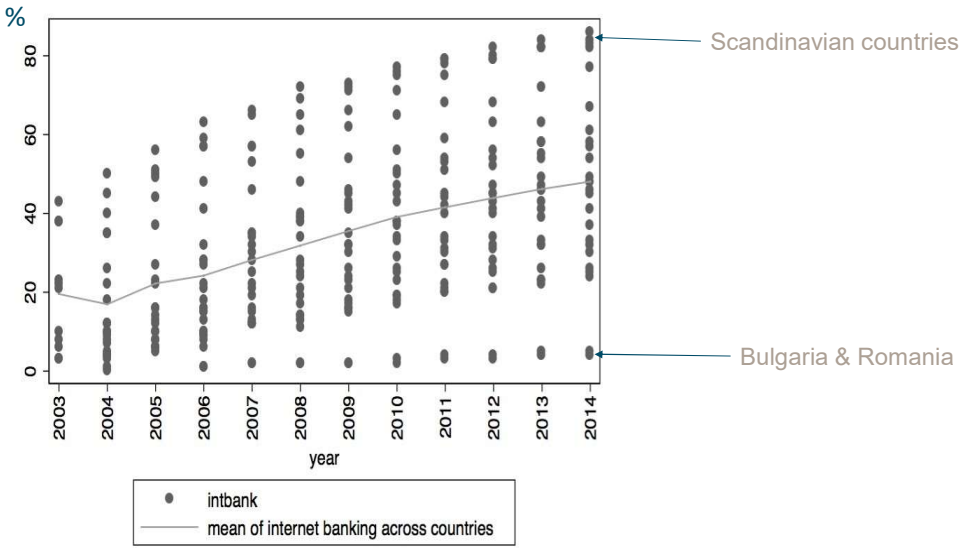
How does the internet affect markets?

- Comparison shopping, search and switching
- Product delivery and perceived product quality
  - Product delivery
    - Goods still require physical delivery either via shop or by post
    - Services can sometimes be delivered digitally
  - Firms
    - Investment in internet delivery less than 'bricks & mortar' (b&m) network of retail outlets
      - Particularly relevant when supplier integrated with retail (e.g. banks)
  - Consumers
    - Internet often more convenient than b&m
      - Eliminates travel and delay costs
  - Market structure
    - Opportunities for entry
    - Potential elimination of geographic boundaries
      - Political and regulatory boundaries remain
- Internet banking
  - A digital service traditionally delivered through expensive, integrated b&m networks
  - B&m networks highly regional in some countries in Europe – but not in all
    - E.g. expansion of b&m retail networks around different initial locations

Questions we address

- How does market structure affect the introduction and consumer uptake of a new product (i.e. internet banking)?
- How does internet banking, in turn, change market structure?
- What do our results tell us about competition?

Internet banking uptake varies greatly across EU Member States and over time



Does initial market structure affect the diffusion of internet banking?

- Innovation process
  - Invention: internet arrived as manna from heaven
  - Adoption of transactional interface by banks
    - Invest in interface, marketing, etc.
      - Limited empirical literature on banking innovations
  - Uptake across consumers
    - How attractive is the internet banking offer to consumers
      - Market structure mattered for mobile phones (Li & Lyons [2012])
- Consumer uptake (diffusion)
  - Demand-side factors
    - E.g. access to internet, **convenience of b&m network**, demographics
  - Supply-side factors
    - E.g. **price**, **marketing** and **investment** (including design of interface)

→ *Market structure may matter through observed and unobserved mechanisms*

Measurement of market structure

- Market definition (as used by European Central Bank)
  - 'Retail banking' = credit institutions
    - Take deposits or issue means of payment in form of electronic money
    - Bank and market size measured by total assets
  - EU Member State (MS)
    - Assets measured on residence basis (i.e. includes activity of foreign banks in MS and excludes activity of domestic banks abroad)
- Market structure
  - National concentration (C)
    - C5 = 5-firm concentration ratio; HHI
    - 15 MS for 1997-2014; 27 for 2001-14 (i.e. including those acceding in 2004)
  - Regionalisation within a Member State (R)
    - New measure based on where banks have headquarters
    - $R = \left[1 - \sum_{i=1}^{K} \left(\frac{B_i}{B}\right)^2\right]$ where: *K* regions, B_i= assets of banks with HQ in region *i*

Our measure of Regionalisation within each country

Country	R index
Austria	0.48
Belgium	0
Bulgaria	0
Cyprus	0
Czech Republic	0
Denmark	0.20
Estonia	0
Finland	0.07
France	0
Germany	0.69
Greece	0.00
Hungary	0
Ireland	0
Italy	0.70
Latvia	0
Lithuania	0
Luxembourg	0
Malta	0
Netherlands	0.50
Poland	0.04
Portugal	0.53
Romania	0.26
Slovakia	0
Slovenia	0.38
Spain	0.68
Sweden	0.00
United Kingdom	0.40

Factors affecting the diffusion of internet banking

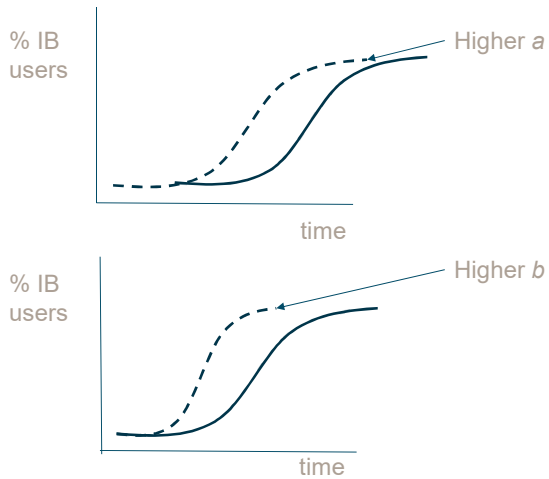
- Variables affecting uptake of internet banking
  - C = C5 or HHI; $C5 \in (22\%, 99\%)$ and $HHI \in (0.02, 0.40)$
  - R = regionalisation index
  - B = branch density (branches per km^2)
  - E = education (tertiary)
  - G = GDP pc
  - t = time
  - Adults with access to internet
  - Crisis state aid for banks
- Identification variables
  - Population, population density
- Sources
  - ECB structural reports, Banker, World Telecommunication Union, Eurostat, DG Comp

How to interpret our diffusion estimates for internet bank usage

- Consumer uptake follows S-shaped logistic function of Griliches (1957)
  - $y_{it} = \frac{y^*_{it}}{1+e^{(-a_{it}-b_{it}t)}}$ → $IB_{it} = ln\left(\frac{y_{it}}{y^*_{it}-y_{it}}\right) = a_{it} + b_{it}t + error$

  where y = number of users, y^* = number of potential users, t = time
- *We estimate*
  - a = 'timing' parameter (high if early start)
  - b = speed of adoption by consumers
    = growth rate of users relative to proportion who have not yet started
- *We assume*
  - y^* = number of adults with access to internet
  - $a_{it} = a(C_{it}, R_{it}, \dots)$
  - $b_{it} = b(C_{it}, R_{it}, \dots)$

How to interpret our diffusion estimates for internet bank usage



Estimation methodology

- Endogeneity
  - The problem
    - Need to identify causality between variables
      - E.g. concentration and internet banking
  - Identification strategy
    - Population (for concentration); population density (for branch density)
  - Control function estimation (Wooldridge [2015])
    - Use 1st stage residuals (r_{it}) in 2nd stage estimation
- Unobserved heterogeneity
  - The problem
    - Unobserved national factors may make a country particularly receptive to internet banking
  - Correlated random effects for unbalanced panel estimation (Mundlak [1978], Wooldridge [2010])
    - Use time-averages of time-varying variables as controls

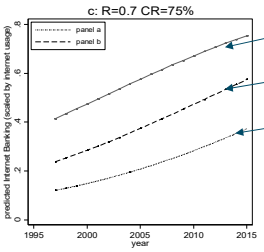
How market structure affects the timing and speed of consumer adoption of internet banking

Table 2 Estimating the diffusion of IB

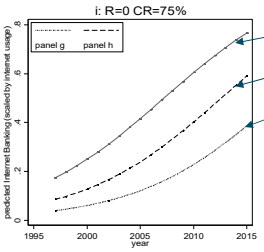
	C measured by $CR5$		C measured by HHI	
	Spec 1	**Spec 2**	Spec 1	**Spec 2**
C	0.022**	0.033***	7.629***	8.034***
B	0.071	0.051	0.208*	0.191
R	1.712***	1.830**	1.232**	1.212*
E	0.012	-0.020*	-0.007	-0.021
G	0.925	1.331	1.458	1.614*
t	-0.119	0.105**	0.099	0.100**
$C*t$	0.001		0.033	
$B*t$	-0.016*	-0.014*	-0.016*	-0.015*
$R*t$	-0.094**	-0.101**	-0.085**	-0.082*
$E*t$	-0.002		-0.001	
$G*t$	0.022		0.002	
constant	-14.710***	-17.054***	-11.381**	-11.281***
$\hat{r}_{it}^{C}$	-0.011**	-0.011**	-2.947***	-2.902**
$\hat{r}_{it}^{B}$	0.086	0.079	-0.025	-0.020
F test to compare spec 1 and spec 2	0.77		0.14	
Adjusted R^2	0.82	0.82	0.82	0.82
No. of Obs.	286	286	286	286

Dense branch network does not affect timing but does slow down speed of consumer uptake

Internet banking *starts earlier* in (nationally) more *concentrated* markets, but then concentration *does not affect the speed* of diffusion



Regionalised markets



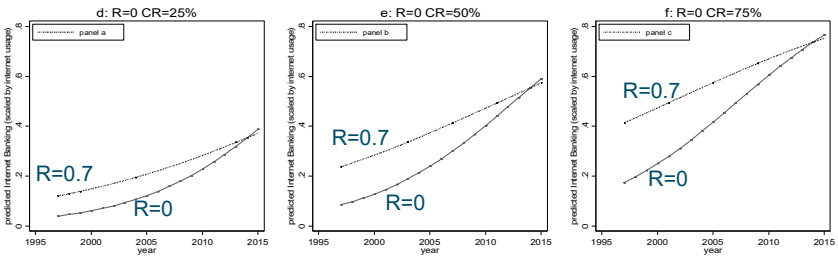
Non-regionalised markets

Possible explanations:
Ability to invest in required quality; customer base to spread overheads; reputation with customers; [lower service quality of branches?]

Internet banking starts earlier in more *regionalised* markets, but then grows more slowly – convergence was reached in 2015

Possible explanations:
Early incentive for regional banks to take customers from other regions; regional loyalties slow down growth

C5 = 25% C5 = 50% C5 = 75%



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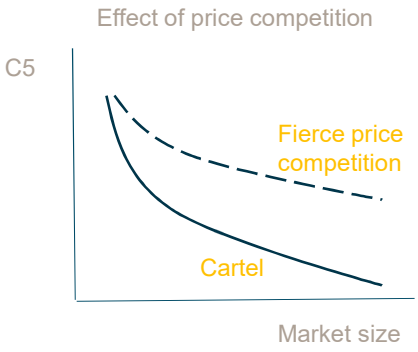
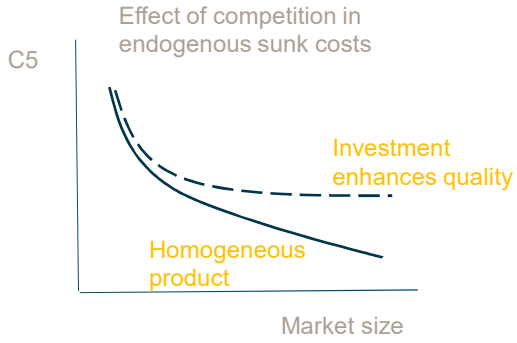
Sutton's framework for understanding market structure

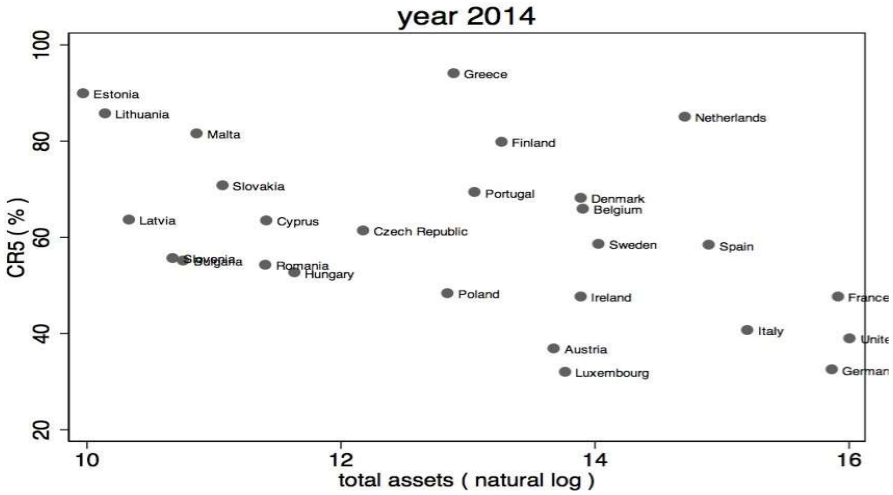
- Fundamental forces
  - Market size
  - Economies of scale
  - 'Toughness' of competition
    - E.g. cartel vs fierce price competition
  - Product differentiation (quality vs horizontal)
    - Endogenous sunk costs (e.g. investment in b&m branch network)
  - Regulation
  - Historical idiosyncrasies
    - E.g. Japan's sugar market
- Relationship between concentration and market size
  - Reveals something about price competition
  - Changes with nature of product differentiation and investment in quality
  - 'Bounds approach' can be appropriate if many unobserved influences

Relationship between concentration and market size depends on toughness of price competition and importance of endogenous sunk costs





Concentration and market size in European countries



Empirical methodology

- Standard Sutton (1991, etc) functional form: $log\left(\frac{C_{it}}{100-C_{it}}\right) = \alpha + \beta\left(\frac{1}{lnS_{it}}\right) + \gamma B_{it}$
  - Also
    - Time trend, t
    - Interact variables with R_i
      - To distinguish differences between regionalised and national markets
      - *Expect lower national concentration if different leading banks in each region*
    - Further interact all variables with D_{it}
      - To distinguish pre- and post-IB relationship
- Distinguish pre-IB and post-IB periods for each country
  - D_{it} = 1 if internet banking penetration > median in sample; D_{it} = 0 otherwise
    - Sensitivity analysis around cut-off
  - *Expect internet banking to reduce concentration…*
    - …if investment in branch network becomes relatively less important for quality
  - Financial crisis effect?
    - Sensitivity test using State aid for banks… but insignificant
- Estimation method similar to internet banking estimation
  - Not lower bound estimation, but this gives similar results

Estimation results for concentration equation

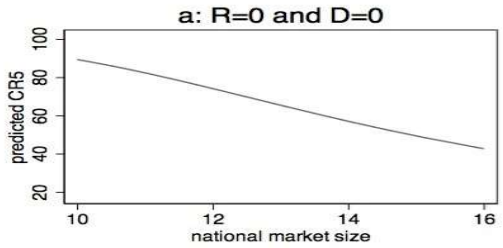
Table 3 estimating the relationship between market size and concentration

Dependent variable: $\log(\frac{C_{it}}{100-C_{it}})$	Estimated coefficients
t	0.102***
$1/\ln S_{it}$	64.677***
R_i	-5.462***
B_{it}	0.331***
$R_i*(1/\ln S_{it})$	61.311***
D	-3.252***
$D*(t)$	-0.080***
$D*(1/\ln S_{it})$	43.068***
$D*R_i$	6.859***
$D*B_{it}$	-0.167***
$D*R_i*(1/\ln S_{it})$	-86.829***
$\hat{e}_{it}^{S}$	-0.143**
$\hat{e}_{it}^{B}$	-0.459***
e_{it}^{IB}	0.141
Constant	9.389***
Adjusted R^2	0.73
No of Obs.	364

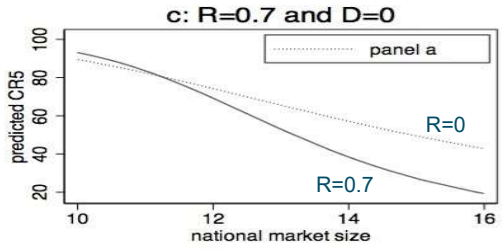
Higher branch density associated with higher concentration…

…but much less important once internet banking has taken hold

Regionalised countries have lower *national* concentration (but w*ithin-region* concentration may be high)



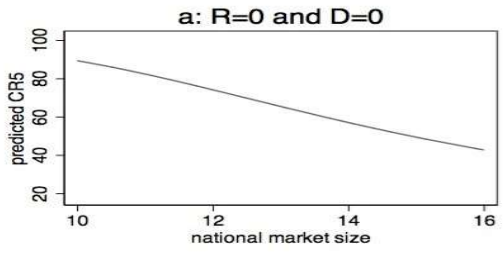
C5 falls c.8% points for each doubling of market size

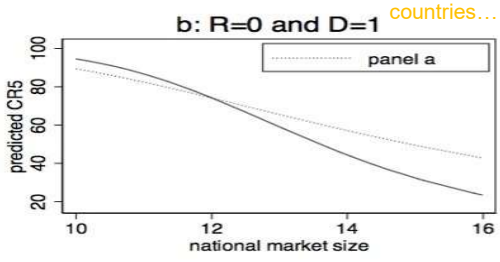


Regionalisation reduces national concentration, particularly in larger markets

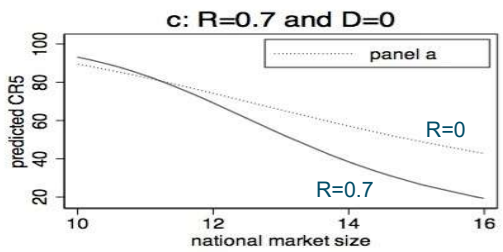
Internet banking results in convergence of relationship between concentration and national market size

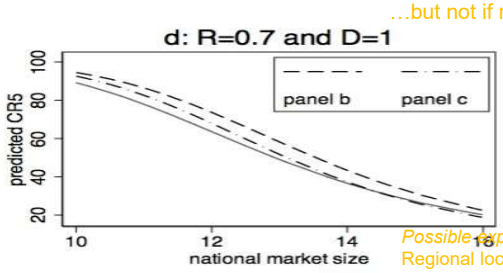
IB reduces C5 in bigger non-regionalised countries…





…but not if regionalised





Possible explanation: Regional location matters less for competition; entry

Summary and some implications for competition

- Introduction and take-up of internet banking
  - Starts earlier in (nationally) more *concentrated* markets
    - But then concentration does not affect the speed of diffusion
    - Ability to invest; reputation; customer base; fear of entry; lower service quality of branches?
  - Starts earlier in more *regionalised* markets
    - But then grows more slowly – convergence
    - Early incentive for regional banks to take customers; regional loyalties slow down growth?
- Effect of internet banking on market structure
  - *Pre-IB*: regionalised countries have lower national concentration
    - But within-region concentration may be high
  - *Post-IB*: convergence of relationship between concentration and national market size
    - Consistent with regional location of banks being less important for competition
    - Also, with entry in non-regionalised markets
- Implications of internet for competition and market structure
  - Within the range of observed concentration…
    - …more concentrated markets can have a greater incentive to promote innovative products
  - Internet provides a route to market integration, so enhancing competition
    - …even if measured national concentration changes little
  - Internet can lead to lower concentration in large national markets (e.g. entry)