Market Power and Merger Simulation in Retail Banking

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Goal

- Build a structural model of banking industry to analyse competition, regulation, mergers, macroeconomic effects…..

Empirical methods for measuring competition in banking

- Structure-Conduct-Performance based measures:
- Herfindahl index

- Reduced form methods:
- Panzar-Rosse test
- Conjectural variation

- Advantages:

- easy to implement
- low data requirement
- the result is a number

- Problems:

- endogeneity
- no theoretical backround
- policy changes cannot be simulated
- homogenous products
- Hyde and Perloff (1995), Corts (1999), Nevo (1998)

Empirical methods for measuring competition in IO: structural models

- Advantages:
- derived from utility and profit-maximization
- product differentiation explicit
- richer demand and supply specification
- policy experiments possible

- Disadvantages:
- data requirement large
- lots of structural assumptions
- outcome is not a number

Plan

- Literature Review
- Model
  - Discrete Choice Demand
  - Two Models of Supply
  - Translog Cost Function
- Results
- Future work

Literature review

- Discrete Choice Demand Estimation: Berry (1994), Berry- Levinshon -Pakes (1995), Nevo (2001)

- Banking applications:

- Demand: Dick (2002), Ishii (2005), Knittel and Stango (2008)
- Competition: Nakane et al. (2006), Molnar et al. (2006), Ho (2007)
- Mergers, scope of banks, switching cost: Ho (2008), Miller (2008), Zhou (2008)

Building blocks of structural approach

1. Demand functions of banking products
2. Supply models of banking: competition with differentiated products and collusion
3. 1. and 2. give predictions about the size of price-cost margins as functions of own- and cross-price elasticities
4. Cost function to calculate “observed” price-cost margins

1. Discrete-choice demand

- Products are bundles of characteristics.
- Preferences are defined on characteristics.
- Each heterogeneous consumer chooses a bundle (bank) to maximize its utility.
- Aggregate demand can be obtained by integrating individual choices.

Utility maximization

$$u_{ijt}^{d} = \delta_{jt}^{d} + \epsilon_{ijt} = r_{jt}^{d}\alpha^{d} - r_{jt}^{sd}\alpha^{s} + x_{jt}\beta^{d} + \xi_{jt}^{d} + \epsilon_{ijt},$$

r^{d}_{jt} - deposit interest rate

r^{sd}_{jt} - service charges/ fees

x_{jt} - observed product/bank characteristics (age, # of branches, employees per branch,…)

ξ_{j} - unobserved product characteristics

ε_{ijt} - consumer *i*'s unobservable preference for product *j* ~ iid, type I extreme distribution

Estimated deposit demand

Logit

$$\ln\left(S_{jt}\right)-\ln\left(S_{0t}\right)=\delta_{jt}^{d}\equiv r_{jt}^{d}\alpha^{d}-r_{jt}^{sd}\alpha^{sd}+x_{jt}\beta^{d}+\xi_{jt}$$

Deposit Demand, GMM

F(5, 11) = 131.04
Prob > F = 0.0000
Centered R2 = 0.4677
Uncentered R2 = 0.4989

First Stage F stat Interest = 1455.26***
First Stage F stat Fee = 236.01***
Number of Observation = 90

Market share	Coef.	Robust Std. Err.	z	[95% Conf.	Interval]
Interest rate	**624.006**	130.088	4.80	369.03	878.97
Fee	**-10.049**	1.19	-9.07	-12.22	-7.87
Branch	**.002**	.0004	5.63	.001	.003
Employees/branch	-.001	.0029	-0.57	-.007	.003
Satisfaction	**.558**	.171	3.50	.246	.87
Constant	**-12.365**	2.472	-5.00	-17.213	-7.52

Anderson canon. corr. LR statistic (identification/IV relevance test): 135.568
Chi-sq(5) P-val = 0.0000

Hansen J statistic (overidentification test of all instruments): 5.212
Chi-sq(4) P-val = 0.2662

Instrumented: Interest, Fee
Included instruments: numbranch numempbr dcs, time dummies
Excluded instruments: lfee adminperasset IVsalaries IVnumempbr IVnumbranch

Loan demand, GMM

F(5, 11) = 159.18
Prob > F = 0.0000
Centered R2 = 0.0458
Uncentered R2 = 0.6258

First Stage F stat Interest = 51.21***
First Stage F stat Interest = 21717.04***
Number of Observation = 92

Market Share	Coef.	Robust Std. Err.	z	[95% Conf.	Interval]
Loan Interest	**-78.1260**	25.1823	-3.10	-127.482	-28.769
Fees on loans	**-2.7867**	.5007	-5.57	-3.768	-1.805
Branches	**.0058**	.0004	13.20	.005	.006
Employees/branch	**.0424**	.0095	4.43	.023	.061
Satisfaction	**.8937**	.2269	3.94	.448	1.338
Constant	**-.4784**	.8281	-0.58	-2.101	1.144

Anderson canon. corr. LR statistic (identification/IV relevance test): 24.034
Chi-sq(5) P-val = 0.0002

Hansen J statistic (overidentification test of all instruments): 1.628
Chi-sq(4) P-val = 0.8037

Instrumented: Interest, Fee
Included instruments: numbranch, numempbr, dcs, time dummies
Excluded instruments: Lo1fee IVsalaries adminperasset IVnumempbr IVnumbranch

2. Supply side

- 2 outputs (loans, deposit services)
- 2 inputs (labor, capital)
- Two extreme models. Bank choose interest rates and fees:

- Independently
- Jointly

Profit Maximization: Competition

$$\underset{r_{jt}^{sd},r_{jt}^{d},r_{jt}^{l},r_{jt}^{sl}}{\text{Max}} \quad \pi_j = \left(r_{jt}^{sd} - r_{jt}^{d}\right) I_t s_{jt}^{d}(\delta^d) + \left(r_{jt}^{l} + r_{jt}^{sl}\right) M_t s_{jt}^{l}(\delta^l) - C_{jt}\left(I_t s_{jt}^{d}(\delta^d), M_t s_{jt}^{l}(\delta^l)\right) + R_{jt} r_t$$

$$\text{st.} \qquad I_t s_{jt}^{d}(\delta^d) = M_t s_{jt}^{l}(\delta^l) + R_{jt}$$

Profit maximization: Cartel

$$\underset{r_{jt}^{sd},r_{jt}^{d},r_{jt}^{l},r_{jt}^{sl}\ j=1,..J}{\text{Max}} \sum_{j=1}^{J} \pi_j = \sum_{j=1}^{J} \left(\begin{array}{c} \left(r_{jt}^{sd} - r_{jt}^{d}\right) I_t s_{jt}^{d}(\delta^d) + \left(r_{jt}^{l} + r_{jt}^{sl}\right) M_t s_{jt}^{l}(\delta^l) \\ -C_{jt}\left(I_t s_{jt}^{d}(\delta^d), M_t s_{jt}^{l}(\delta^l)\right) + R_{jt} r_t \end{array} \right)$$

$$\text{st.} \qquad I_t s_{jt}^{d}(\delta^d) = M_t s_{jt}^{l}(\delta^l) + R_{jt}$$

3. Estimated price-cost margins for loan and deposit market

$$\left(r_{jt}^{sd} - r_{jt}^{d} + r_t - c_{jt}^{d}\right) = \frac{s_{jt}^{d}\left(\delta^{d}\right)}{\frac{\partial s_{jt}^{d}\left(\delta^{d}\right)}{\partial r_{jt}^{d}}} - \sum_{k \neq j}\left(r_{kt}^{sd} - r_{kt}^{d} + r_t - c_{kt}^{d}\right)\frac{\frac{\partial s_{kt}^{d}\left(\delta^{d}\right)}{\partial r_{jt}^{d}}}{\frac{\partial s_{jt}^{d}\left(\delta^{d}\right)}{\partial r_{jt}^{d}}}$$

$$\left(r_{jt}^{sl} + r_{jt}^{l} - r_t - c_{jt}^{l}\right) = -\frac{s_{jt}^{l}\left(\delta^{l}\right)}{\frac{\partial s_{jt}^{l}\left(\delta^{l}\right)}{\partial r_{jt}^{l}}} - \sum_{k \neq j}\left(r_{kt}^{sl} + r_{kt}^{l} - r_t - c_{kt}^{l}\right)\frac{\frac{\partial s_{kt}^{l}\left(\delta^{l}\right)}{\partial r_{jt}^{l}}}{\frac{\partial s_{jt}^{l}\left(\delta^{l}\right)}{\partial r_{jt}^{l}}}$$

Left-hand side: Estimated marginal cost implies “observed” margins.

Right-hand side: Models predict competitive and cartel margins.

4. Translog Cost function

- Zero marginal cost (c=0)
- Estimated marginal cost from translog cost function and inputs' cost share with the usual symmetry and linear homogeneity restrictions

$$\ln(TC_{jt}) = \lambda + \sum_n \tau^n \ln Q_{jt}^n + \sum_m \upsilon^m \ln P_{jt}^m + \frac{1}{2} \sum_n \sum_p \phi_{np} (\ln Q_{jt}^n \ln Q_{jt}^p)$$
$$+ (\frac{1}{2}) \sum_m \sum_r \varphi_{mr} (\ln P_{jt}^m \ln P_{jt}^r) + \sum_n \sum_m \chi_{nm} \ln Q_{jt}^n \ln P_{jt}^m + \eta_{it},$$

$$S_{jt}^m = \upsilon^m + \sum_r \varphi_{mr} \ln P_{jt}^r + \sum_n \chi_{nm} \ln Q_{jt}^n + \vartheta_{it}^m$$

The estimated marginal cost is:

$$c_{jt} = \frac{TC_{jt}}{Q_{jt}^1} (\tau^1 + \phi_{11} \ln Q_{jt}^1 + \frac{1}{2} \phi_{12} \ln Q_{jt}^2 + \chi_{11} \ln P_{jt}^1 + \chi_{12} \ln P_{jt}^2).$$

Summary: Loans' weighted PCMs

Variable	Mean	Std. Dev.	Min	Max
PCM Bertrand	0.37	.073	.1468	.514
PCM Cartel	1.12	.293	.6110	1.883
PCM Zero cost	0.52	.433	.0665	33.315
MC	0.011	.0084	.0017	.1069
PCM Est. MC	0.27	.47	-2.7441	32.981

Summary: Deposits' weighted PCMs

Variable	Mean	Std. Dev.	Min	Max
PCM Bertrand	.118	.051	.047	.22
PCM Cartel	.941	.403	.447	1.89
PCM No cost	.399	.656	.081	17.43
MC	.032	.012	.0008	.06
PCM Est. cost	-1.07	.877	-2.93	16.27

Bank by bank comparison of PCMs

	Loan	Deposit
Below Bertrand	62%	85%
Above Cartel	0%	12%

Compare Finland to Hungary

- Finland: 3 bank's has 70% of the market
- Hungary is less concentrated

	Pers. Loan	Short Deposit
Below Bertrand	3.05%	2.72%
Above Cartel	78.69%	77.69%

Figure 7: Concentration ratios: CR3 and CR5. Year 2004
Intra-sample share (retail income) extrapolated with deposits*

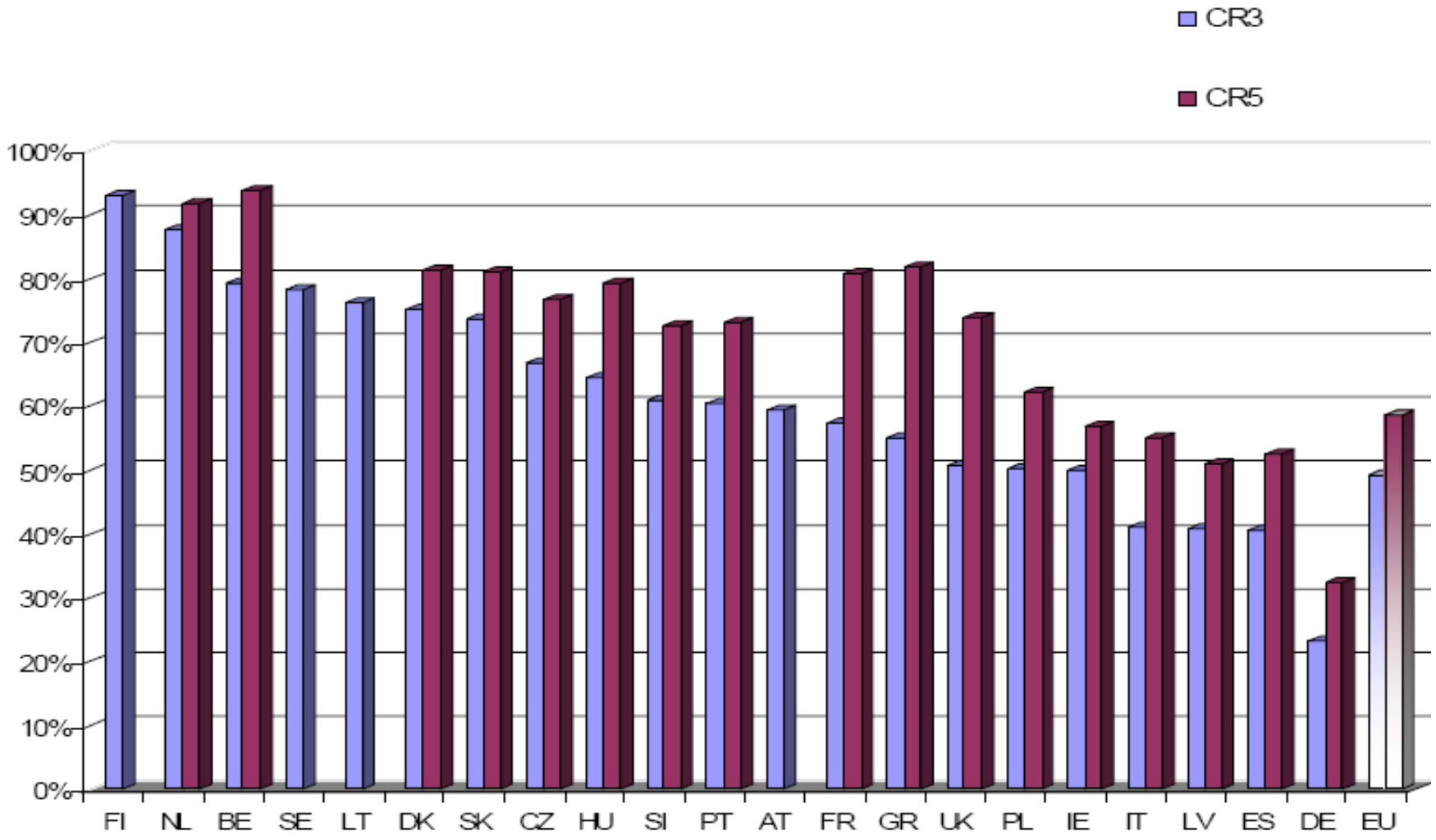
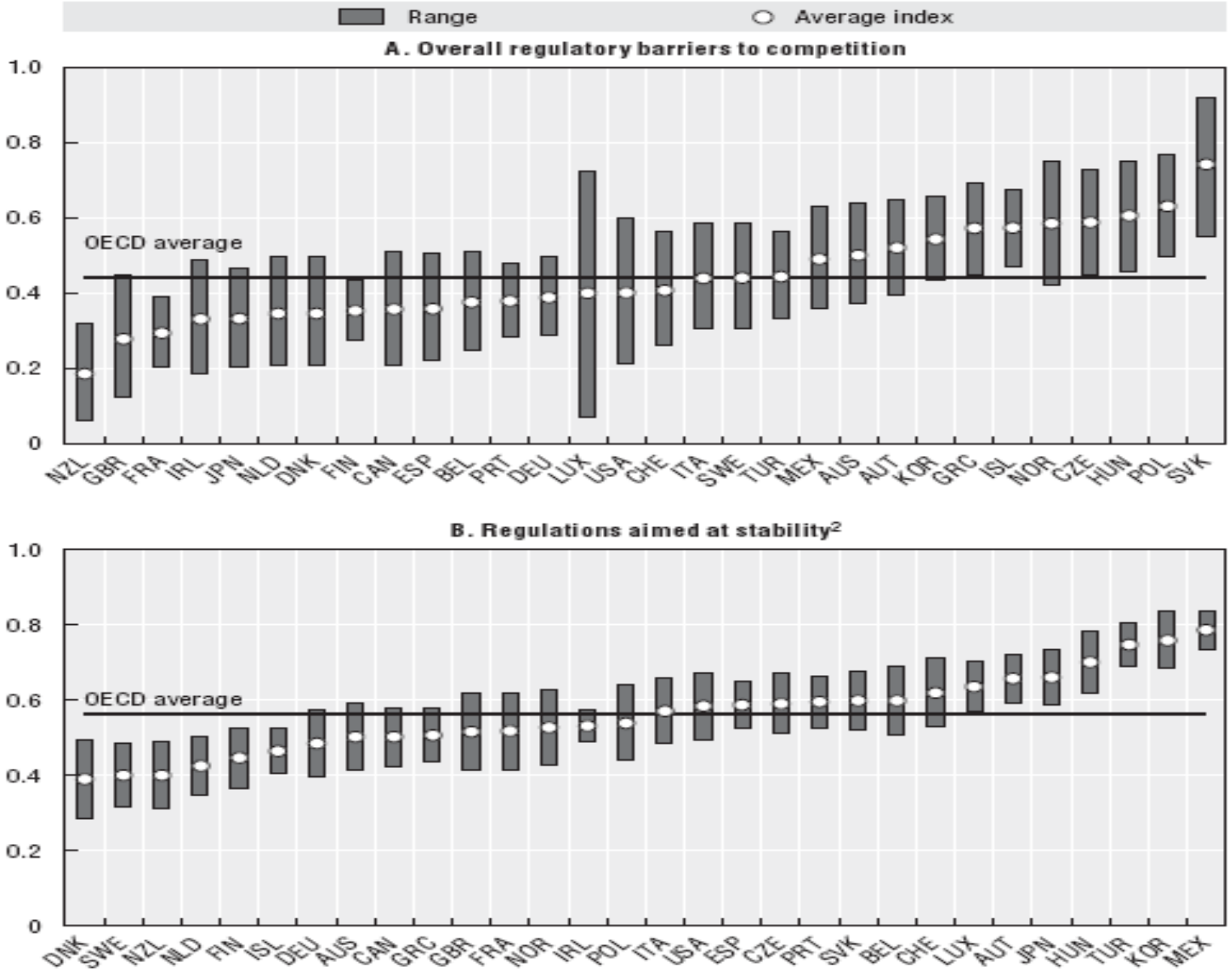


Figure 2. **Banking regulation indices, 2003**[1]



1. The scale of the indicator is 0-1 from least to most restrictive. A higher value indicates more competition-restraining regulation.
2. Covers different measures related to prudential regulation of the banking sector.

Source: OECD; World Bank, Bank Regulation and Supervision Database.

Merger Simulation

- Structural model can be used to make counterfactual experiments
- Consider the merger of 2 of the 3 biggest banks and assume that no cost savings
- With the previously estimated parameters compute the new equilibrium

Predicted markup after the merger

- Deposit weighted average markup increase from 0.16 to 0.19.
- 10 basis point decrease in deposit rates

- Loan weighted average markup increase from to 0.36 to 0.76 .
- 70 basis point increase in loan rates

Future work

- More consumer heterogeneity, BLP
- Better model of banking: moral hazard, adverse selection, dynamics?
- Other than price aspects of competition: i.e. advertising, …

Summary

- Existing measures of competition in the banking literature are faulty!
- New, structural models needed!
- This paper is a small step to the right direction.