

Banking Competition Efficiency in Europe: A Frontier Approach

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Outline

- Motivation/background:
 - lower payment costs improves competition in single euro market (SEPA)
 - large differences in bank service prices exist in Europe (EC report, 2007)
- Main idea:
 - service pricing data limited or confidential; use revenue information instead
 - borrow from “frontier analysis” to separate cost of producing fee-based services from competition effects on raising fee-based revenues
 - focus on non-interest income and spread (securities returns are competitive)
- Framework: Frontier analysis
 - data used, model specification
 - assessing cross-country competition, revenue elasticities
 - comparison with other competition measures

Motivation/background

- EC report (2007) outlined how specific bank fees for payment and other services differ markedly across Europe (but countries rarely identified; confidential).
- Among others, the report compared:
 - account maintenance fees
 - consumer transaction fees
 - market rate/deposit interest rate spread
 - merchant card interchange fees
 - account switching fees
 - tying loans to first having a deposit
 - cross-country banking profitability
- Found price differences “too large” to be due solely to cost differences, suggesting markedly different competition levels across Europe.

Motivation/background

- Comparing individual service prices can be misleading. A high price for one bank service compared to other countries can be offset by a low price for a different service or low interest paid on deposits at the same bank.
- Price data is limited. Use revenue information instead.
- Recent theoretical IO literature suggests that revenue focus can be superior to price information in assessing competition (Boone, 2008a, 2008b).
- Importance of retail banking in Europe:
 - accounts for $\approx 50\%$ of total banking activity or € 275 billion
 - generates around 2% of European GDP and 3 million jobs.
- Conclude: competitive efficiency is important in general and for SEPA.

Main idea

- Bank fee/service pricing can differ due to:
 - lack of competition (the thrust of the EC report) or
 - service cost/productivity differences across countries.
- Model framework:
retail banking revenues = f(cost, productivity, competition)
- Maintained hypothesis:
 - if can “explain” cost/productivity effects on banking revenues, then unexplained revenues “left over” reflects competition + normal error.
 - use Distribution Free frontier model (Berger, 1993) to average normal error close to zero, leaving average effect of competition on revenue.
- Three revenue flows: non-interest income, loan-deposit rate spread, and securities revenues (security revenues determined in a competitive market).

Framework

- The *usual* approach would neglect costs and “explain” cross-country service price/profit differences using:

banking prices/profits = g (competition measure, controls)

- Herfindahl-Hirschman Index: banking market concentration. Problem: suggests *potential* competition so need data on ease of new firm entry.
- Lerner Index: mark-up of price over marginal cost. Problem: price information is limited and need to estimate marginal cost.
- H-Statistic: regression of $P_output = \beta (P_input) + \gamma (...)$
a value of $\beta < 1.0$ indicates imperfect competition since output and input prices are not closely related. Problem: how close to 1.0 should β be to indicate effective competition?

Framework

- Main problem: expect the 3 “standard” indicators to be positively correlated as they purport to measure the same thing—namely, competition.
- Analysis shows that correlations are low (R^2 s \approx .05 to .09) and often negative (H-statistic adjusted so higher value implies less competition).
- Occurs across 14 European countries (1,912 banks). Similar results within countries over time (Carbo, Humphrey, Maudos, Molyneux, 2009).
- Thus choice of competition measure can affect the conclusions obtained
- Alternative: develop a procedure where measure competition indirectly rather than choose a direct indicator.

Framework

- Our approach: use frontier efficiency analysis to indicate competition:

$$\ln \text{revenue} = f(\ln \text{cost}, \ln \text{productivity}) + \ln e + \ln u$$

Assumption: random error ($\ln e$) will average close to zero in separate cross-section estimations in panel data while the average of $\ln u$ that remains will reflect the average effect of competition.

Bank/country with lowest average residual ($\ln u$) is also the bank/country where variation in underlying cost and productivity explains the greatest amount of the variation in revenues.

- This minimum value determines the frontier. Competitive efficiency (CE) of a given bank/country is measured relative to this frontier:

$$CE_i = \bar{u}_i / \bar{u}_{\min} - 1$$

Industrial organization literature

- Indicator of competition (plus fixed costs) using relative profit concept: (Boone, 2008a, 2008b)

Calculation from reported data, not estimation:

Profit = Total reported costs – Total variable costs

Relative Profits_i = (Profit_i - Profit_{min})/(Profit_{max} - Profit_{min})
gives index 0.0 (when i = min) to 1.0 (when i = max)

- Relative profits combines actual profits with unknown cost of fixed inputs. Higher index value reflects less competition for all firm operations.
- We use statistical cost analysis to assign costs to fixed and variable inputs, leaving an indicator of “excess” revenue to measure effect of competition.

$$CE_i = \bar{u}_i / \bar{u}_{\min} - 1$$

Data

- Data covers 11 countries over 20 years: 1987 to 2006.

France

Netherlands

Denmark

Germany

Spain

Finland

U.K.

Belgium

Norway

Italy

Sweden

- Can determine the degree of banking market competition in one country relative to another. Can not determine the absolute level of competition, even for the most competitive country.

Data

Table 1: Revenue and Cost Growth Rates: 11 Countries, 1987-2006

	Revenue 1	Operating Cost (OC) 2	Non-Interest Income/OC 3	Spread/ OC 4	PL 5	Labor/ Deposits 6	Payment Cost 7	ATM/ Deposits 8
Sweden	7.0%	4.4%	7.2%	-1.8%	5.8%	-6.0%	-3.3%	-3.7%
Norway	1.5	2.3	1.5	-2.5	5.3	-7.0	-4.4	-2.1
Netherlands	7.7	6.5	4.2	-1.1	4.6	-7.3	-4.5	6.4
Belgium	8.0	3.8	4.7	3.7	4.5	-7.6	-3.6	3.7
Finland	2.7	1.6	2.5	-0.2	3.1	-8.9	-4.8	-5.6
France	6.1	4.3	7.1	-1.6	4.6	-5.3	-2.7	2.0
Denmark	4.9	3.7	7.2	-0.9	4.9	-5.4	-5.0	5.0
Germany	4.2	5.5	3.0	-2.5	4.4	-5.4	-3.9	3.9
Italy	4.5	3.8	3.8	-0.9	2.6	-6.0	-3.2	4.8
U.K.	5.0	6.5	-0.4	-1.8	5.4	-7.4	-3.2	-0.7
Spain	2.4	4.2	6.0	-3.9	3.8	-6.7	-6.5	4.3
Average	4.9	4.2	4.3	-1.2	4.4	-6.6	-4.1	1.6

- Revenues rose by 160% while operating costs rose by 128%.
- Share of non-interest revenues was 20% now is 44% ; spread share fell.
- Labor cost share fell as did unit payment costs (due to scale economies).

Model

- Translog equations regress revenues on cost and productivity (SUR estimation).
- Residuals averaged across countries over 3 time periods to compute CE_i

$$\ln(NII/OC) = \alpha_0 + \sum_{i=1}^5 \alpha_i \ln X_i + 1/2 \sum_{i=1}^5 \sum_{j=1}^5 \alpha_{ij} \ln X_i \ln X_j + \sum_{i=1}^5 \sum_{k=1}^2 \delta_{ik} \ln X_i \ln P_k + \sum_{k=1}^2 \beta_k \ln P_k + 1/2 \sum_{k=1}^2 \sum_{m=1}^2 \beta_{km} \ln P_k \ln P_m \quad (1)$$

$$\ln(SPREAD/OC) = \theta_0 + \sum_{i=1}^5 \theta_i \ln X_i + 1/2 \sum_{i=1}^5 \sum_{j=1}^5 \theta_{ij} \ln X_i \ln X_j + \sum_{i=1}^5 \sum_{k=1}^2 \psi_{ik} \ln X_i \ln P_k + \sum_{k=1}^2 \phi_k \ln P_k + 1/2 \sum_{k=1}^2 \sum_{m=1}^2 \phi_{km} \ln P_k \ln P_m \quad (2)$$

where:

$X_i = L/DEP, ATM/DEP, GAP, PC, ATMC,$

$P_k = PL, PK.$

Variables used

- Cost Influences:

PL = average price of all labor inputs

PK = average opportunity cost of capital (market interest rate)

PC = index of unit payment costs (from scale economy estimate)

ATMC = index of unit ATM costs (from scale economy estimate)

- Productivity Influences:

L/DEP = labor/output ratio (labor productivity in supporting deposits)

ATM/DEP = capital/output ratio (capital productivity)

- Business cycle (exogeneous demand) influence:

GAP = GDP output gap

ATMs have replaced expensive branch offices. Cross-country branch data not comparable: 6 workers per branch in Spain, over 20 in U.K.

Cross-country bank competition efficiency

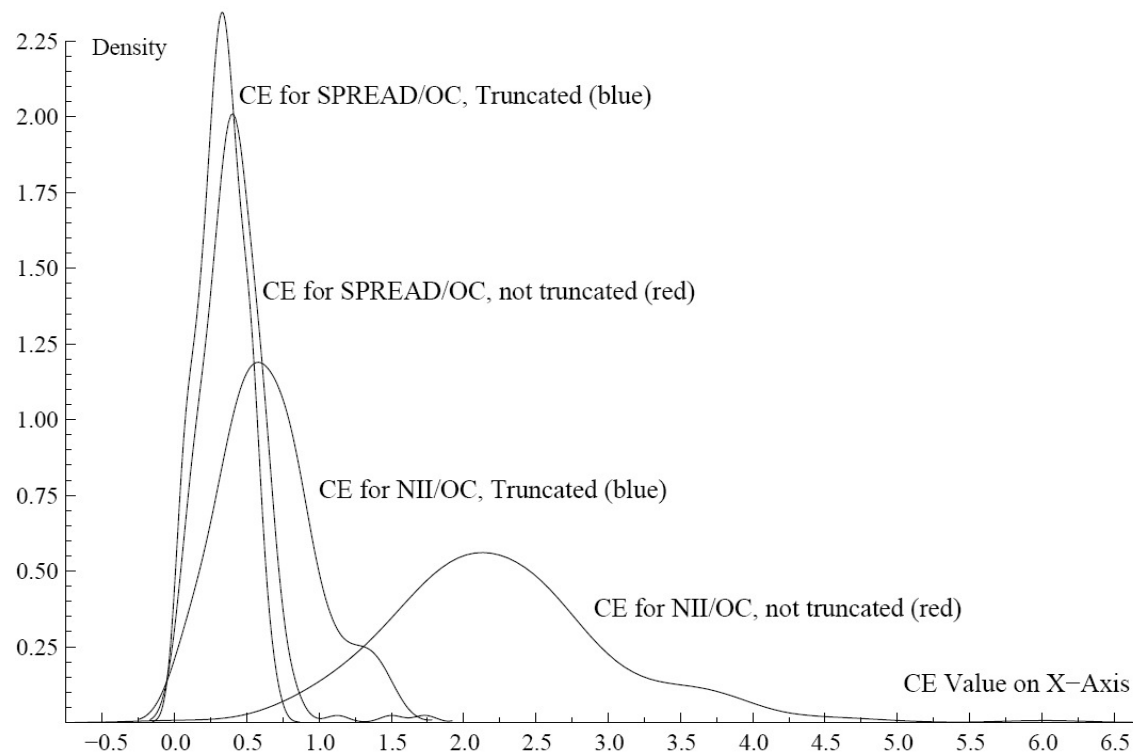
Table 2: Competitive Efficiency for 11 countries, Cross-Section vs. Panel Residual, 1987-2006

	Averaged Residuals:				Panel Residuals:					
	$CE_{NII/OC}$		$CE_{SPREAD/OC}$		$CE_{NII/OC}$		$CE_{SPREAD/OC}$			
Sweden	.140	(11)	.000	(1)	.90	(11)	0	.30	(4)	-3
Norway	.042	(4)	.026	(5)	.53	(2)	+2	.26	(1)	+4
Netherlands	.046	(5)	.034	(8)	.57	(3)	+2	.39	(10)	-2
Belgium	.075	(10)	.017	(4)	.66	(8)	+2	.30	(5)	-1
Finland	.057	(7)	.030	(6)	.64	(7)	0	.34	(6)	0
France	.036	(3)	.008	(2)	.61	(5)	-2	.27	(2)	0
Denmark	.054	(6)	.032	(7)	.60	(4)	+2	.29	(3)	+4
Germany	.065	(8)	.016	(3)	.68	(9)	-1	.36	(8)	-5
Italy	.069	(9)	.036	(10)	.82	(10)	-1	.36	(7)	+3
U.K.	.000	(1)	.091	(11)	.48	(1)	0	.36	(9)	+2
Spain	.028	(2)	.035	(9)	.62	(6)	-4	.39	(11)	-2

- DFA frontier uses residuals averaged across separate cross-section estimations. Panel residuals are not averaged (shown for comparison).
- Falling spread CE consistent with greater competition.
Higher non-interest income CE associated with priced services.

Cross-country bank competition efficiency

- Truncation: 5% of the highest and lowest individual u_i values were removed before CE values were computed—moves frontier closer to mass of the data.
- Little difference in CE results using averaged residuals. Large difference when use unaveraged residuals from panel estimation.



Cross-country bank competition efficiency

- Conclusions so far:
 - Cost and productivity “explains” 84% to 95% of revenue variation over 6 estimations. Unexplained revenue variation is relatively small.
 - average percent that residuals are of the two dependent variables for the 6 estimations were 4%, 6%, 9% (three times), and 13%.
 - effect of competition on cross-country differences in revenue appears to be small. Large differences in individual bank service prices found in the 2007 EC Report do not roll over into similarly large differences in revenues.

Cost elasticities and revenues

Table 4: Elasticities of the Cost Effect on Revenues

	Non-Interest Income Activity Revenues	Loan-Deposit Rate Spread Revenues
Productivity:		
Labor/Deposit ratio	-.42*	-.83*
ATM/Deposit ratio	.06	-.17*
Scale Economy:		
Payment Cost Index	.82*	-.02
ATM Cost Index	.06	-.24*
Factor Input Cost:		
Price of Labor	.01	-1.08*
Capital Opportunity Cost	-.53*	.70*

* Elasticity is significantly different from zero at p-value = .01.

- Lower labor intensity raises NNI and spread revenues (saves cost).
- Lower unit ATM cost increases spread revenue (attracts depositors).
- Lower unit payment cost *decreases* NNI revenue. Why?
Little transaction-based pricing so volume expansion raises operating cost more than revenue even as scale economies reduce unit cost.

Comparison of rankings

Table 6: Most and Least Competitive Countries

	Averaged Residuals:		Other Competition Measures:		
	$CE_{NII/OC}$	$CE_{SPREAD/OC}$	H-Statistic	Profit/Revenue	CR-3
Most Competitive	U.K. Spain France	Sweden France Germany	Netherlands U.K. Germany	Belgium Netherlands Germany	Spain Italy U.K.
Least Competitive	Italy Belgium Sweden	Spain Italy U.K.	Finland Denmark Italy	Sweden Finland Spain	Belgium Netherlands Finland

- Rankings differ according to measure used. R^2 s are very low, except for NII with spread measure (.53).
- Using all 5 indicators, the most competitive countries seem to be Germany and the U.K. The least competitive are Italy and Finland.

Conclusions 1

- We develop a revenue-based measure of bank competition and countries are ranked by their dispersion from a "competition efficiency" frontier.
- Differences in competition play a relatively small role in explaining variation in cross-country bank revenues. Cost/productivity explains 84% to 95%.
- Rather than look at the entire bank, we look at non-interest income and loan-deposit rate spread activities (securities are already competitive).

Conclusions 2

- Non-interest income activities have risen from 20% to 44% of total revenues, but these largely fee-based activities are associated with less competition.
- Pricing payments on a transaction basis would:
 - generate revenues as payment volumes expand
 - transform payments into a “profit center” rather than being a “cost center” where it can be difficult to cover costs as volume expands
- Antitrust policy:
 - relying on a single direct competition indicator may lead to inconsistencies
 - when prices/fees are not tied to expanding volume, they can rise to cover higher total operating cost even though unit costs are falling with scale economies. This can look like the exercise of market power but need not be.