Competition and concentration in the Polish Banking Market
(prior the financial crisis and during the crisis)
- empirical results based on micro data

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• Theory and Literature Review
• Changes in the Structure of the Banking Sector in Poland 1997-2009 (*prior the financial crisis and during the crisis*)
• Competition in the Polish banking sector
  ➢ Panzar and Rosse (P-R) model
  ➢ Lerner index
  ➢ Boone indicator
• Competition in CEC5 (the Czech Republic, Hungary, Slovenia, Slovakia, Poland) based on Bankscope database
• Conclusions
Motivation

Competition between banks is:

• one of the most important factors for stability in the financial sector through its influence on: profitability of banks, access to external funding and the country’s economic development as a whole

• a crucial issue for the EU countries as well as for Poland. This interest is driven by an increasing consolidation in the banking sector, changes in technology and regulation

Question:

• Did the level of competition in the Polish Banking Market change during the financial crisis?
Theory and Literature Review
Theory

There are two major streams to assess competition among banks: methods employed in industrial organisation (IO) and the new empirical approaches (NEIO), specifically applied to banking.

- The approaches consist of the structure-conduct-performance (SCP) paradigm (Bain 1951, Rhoades 1977, Gilbert 1984) and the efficiency structure hypothesis (ESH) (Demsetz 1973); Boone’s model (2008). Concentration ratios (CR$_5$, HHI) are used in formal models explaining competitive performance in the banking industry.

Competition among banks: good or bad? What is special about competition in financial sector?

Competition in the banking industry is necessarily welfare-enhancing (Pagano (1993), Guzman (2000), Cetorelli (2001)), but there are possible channels through which bank competition may generate negative economic effects.

Specific to the financial sector, is the link between competition and stability (Schaeck et al., (2006), Allen and Gale (2004, 2007), Vives (2010)).

Vives (2010) found that competition may increase instability on the liability side, and fostering runs/panics, which may affect the system overall; and increasing the incentives to take risk (on either the liability or asset sides), thus increasing the probability of failure.
Literature Review cont.

Another issue, is the link between competition and concentration; and regulation

A number of analysts, who investigated the trade-off between competition and concentration, found that there is no evidence that banking sector concentration negatively relates to the level of competition (Gelos and Roldos (2002), Yildrim and Philippatoas (2007), Claessens and Laeven (2004), Hempell (2002) Coccorese (2004), Fillipaki and Staikouras (2006))

Bikker et al. (2006, 2007, 2008) demonstrated that the level of competition in the existing P-R literature was systematically overestimated. With the correctly specified P-R model Bikker et al. (2008) proved that further consolidation would reduce competition among banks
Literature Review cont.

• Most studies based on the Lerner index found a reduction of competition during the 90s and higher Lerner index in MU countries (e.g. de Guevara and Maudos, (2004, 2007), de Guevara et al., (2007)); Maudos et al., (2007), de Guevara et al. (2004); Angelini and Cetorelli (2003), Fischer and Hempell (2005) demonstrated an increase in competition

• An increase in competition on the credit market in euro zone countries was demonstrated by Leuvensteijn et al (2007) with the use of the Boone method

• Finally, Carbó et al (2009) found using five measures of competition that the various indicators of competition yield different results about competitive behaviour due to that fact that those competition indicators measure different things
Results related specifically to changes in competition of the financial sector in EMU *prior the financial crisis* are ambiguous

- **on the one hand**, an *increase in competition* has been found (cf. Utrero-González and Callado-Muñoz (2007)), Boucinha and Ribeiro (2009) confirmed increase in competition due to the euro area participation for Portuguese banking system, as well Luis Gutiérrez de Roza (2007) for Spanish banks

- **on the other hand**, the results obtained by Bikker and Spierdijk (2008) in cross-country research indicated a *decrease in competition*, and found that the degree of competition between banking sectors of the „old” and the „new” EU levelled off
Literature Review cont.

Results related specifically to the competition in the Polish banking sector:


Changes in the Structure of the Banking Sector in Poland (1997-2009)

Source: NBP, KNF.
M&As in the Polish Banking between 1997 and 2009

• M&As taking place in 1997-2001 were strictly connected with the process of privatization, based mostly on foreign capital from the euro area, and were influenced by international consolidation.

• In the years 2002-2007 the process of consolidation slowed down, and since 2004 the main trend was to set up branches of foreign credit institutions.

• M&As taking place in 2008-2009 were strictly connected with the financial crisis.
The Number of Polish Commercial Banks and Branches

The number of Polish commercial banks decreased, at the same time the number of foreign branches increased, despite an increase in the number of credit institutions’ branches in Poland (18 in 2009) their share in the market remained insignificant.

Source: NBP, KNF.
HHI and CR$_5$ for Polish Commercial Banks in 1997-2009

Consolidation in the Polish banking sector resulted in changes in concentration measured:

**HHI**

**CR$_5$**

Source: NBP, KNF.
Change of CR$_5$ for Credit Institutions in UE (2004-2009)

Source: NBP, ECB.
Change of the Share of Banking Sector Assets with Majority of Foreign Equity and CR5 in UE (2004-2009)

Source: ECB.
Commercial Banking Sector’s Efficiency Indicators in Poland 1997-2009 (%)

Source: NBP and FSA.
Structural and Technological Changes in the Polish Banking Sector Between 1997 and 2009

• On May 1, 2004, ten countries, including Poland, joined the European Union, one of the results of the accession was the harmonisation of Polish financial law with EU regulations.

• The Internet made the established Polish banking sector more vulnerable to new entrants.

• During the period of crisis in order to stabilized and improved situation on financial market: NBP, Polish Government and Financial Supervision took some activities; despite the strong deterioration in financial performance, the situation of the banking sector was quite stable, also in terms of liquidity.
Empirical results for the Polish Banking Sector

- Panzar and Rosse (P-R) model
- Lerner index
- Boone indicator
Panzar and Rosse Approach

This method implies, that bank $i$ maximizes its profits, where marginal revenue equals marginal cost:

\[ R'_i (y_i, n, z_i) = C'_i (y_i, w_i, t_i) \]  
\[ R^*_i (y^*, n^*, z) = C^*_i (y^*, w^*_i t) \]

where: $R_i$ – revenue function of bank $i$, $C_i$ – cost of bank $i$, $y_i$ – output of bank $i$, $n$ – number of banks, $w_i$ – vector of $m$ factor input prices of bank $i$, $z_i$ – vector of exogenous variables that shift the revenue function, $z_i$ - vector of exogenous variables that shift the cost function, the prime denoting marginal and the asterisk denoting equilibrium values.

\[ H = \sum_{k=1}^{m} \frac{\partial R^*_i}{\partial w_{i k}^*} \frac{w_{i k}}{R^*_i} \]

where: $R^*_i$ – revenue function in the equilibrium, $w_i$ – factor of input prices of bank.

Market power is measured by the extent to which changes in factor input prices ($dw_{ki}$) are reflected in equilibrium revenues ($dR_{i,*}$) earned by bank $i$. 
### Interpretation of the Panzar – Rosse’s H-Statistic

<table>
<thead>
<tr>
<th>Values of H</th>
<th>Competitive Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>H≤0</td>
<td>Monopoly or perfectly collusive oligopoly</td>
</tr>
<tr>
<td>0&lt;H&lt;1</td>
<td>Monopolistic competition</td>
</tr>
<tr>
<td>H=1</td>
<td>Perfect competition or monopoly in a perfectly contestable market</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Values of H</th>
<th>Equilibrium test*</th>
</tr>
</thead>
<tbody>
<tr>
<td>0&lt;H</td>
<td>Disequilibrium</td>
</tr>
<tr>
<td>H=0</td>
<td>Equilibrium</td>
</tr>
</tbody>
</table>

Bikker and Haaf (2002) arrived the empirical reduced-form equation obtained as the product of equilibrium output and the common price level:

$$\ln II = \alpha + a_1 \ln w_f + a_2 \ln w_p + a_3 \ln w_c + \sum \beta_j \text{egz}_j + \eta \ln (OI/II) + \epsilon \quad (4)$$

Where:

- dependent variable $\ln II$ denotes natural logarithm of interest income,
- explanatory variables:
  - $w_f$ – the price of funds,
  - $w_p$ – the price of personal expenses,
  - $w_c$ – the price of capital,
  - $\text{egz}$ – bank-specific exogenous factors,
  - $OI/II$ – the ratio of other income to total assets to capture the increasing role of non-interest revenue in banks’ income
Misspecification in the Panzar and Rosse (P-R) model
Where dependent variable $y_{it} = \ln(II/TA)$ is ‘the price’
  or $y_{it}=\ln(II_{it})$ is ‘the revenue’
the OLS estimator $\hat{\beta}$ is expressed in the usual way (see Bikker et al. (2007)):

$$Y = X' \beta + \epsilon$$
$$Y = \ln(II/TA) or Y = \ln(II)$$
$$\hat{\beta} = (X'X)^{-1} X'Y$$

(5)

$$\hat{\beta}_p = (X'X)^{-1} X'\ln II - (X'X)^{-1} X'\ln TA = \hat{\beta}_r - (X'X)^{-1} X'\ln TA$$

The bias in the H statistic obtained from the P-R model with interest income divided by total assets ($II/TA$):

$$H_p = H_r + bias (TA)$$
Lerner Index of Market Power

Lerner index is a mark-up of price over marginal cost and divergence of price, and measures the capacity to set prices above the marginal cost, being an inverse function of the elasticity of demand $e$ and of the number of banks $N$

The higher the mark-up, the greater the realized market power. The values of the index range from 0 (perfect competition) to 1 (monopoly)

\[
L = \frac{1}{|e| N} = \frac{p - MC}{p} \tag{6}
\]
Lerner index in the case of banking companies \((1)\)

Lerner index expression is obtained from the Monti-Klein (1971) imperfect competition model (see Freixas & Rochet, pp. 78-81).

The bank’s decision variables are \(L\) (the amount of loans) and \(D\) (the amount of deposits), and for simplicity’s sake the level of capital is assumed to be given.

The bank is assumed to be a price taker in the inter-bank market \((r)\) so that the objective function of profits to be maximized is as follows:

\[
\pi(D, L) = (r_L(L) - r) * L + (r - r_D(D)) * D - C(D, L) \tag{7}
\]

The first order conditions with respect to deposits and loans are as follows:

\[
\frac{\partial \pi}{\partial L} = \frac{\partial r_L}{\partial L} L + r_L - r - \frac{\partial C}{\partial L} = 0 \quad \rightarrow \quad \frac{r_L^* - r - \frac{\partial C}{\partial L}}{r_L^*} = \frac{1}{N \varepsilon_L} \tag{8}
\]

\[
\frac{\partial \pi}{\partial D} = -\frac{\partial r_D}{\partial D} D + r - r_D - \frac{\partial C}{\partial D} = 0 \quad \rightarrow \quad \frac{r - r_D^* - \frac{\partial C}{\partial D}}{r_D^*} = \frac{1}{N \varepsilon_D}
\]

\[
L = \frac{1}{\left|e\right| N} = \frac{p - MC}{p}
\]
Data Sources & Estimation

From National Bank of Poland’s Balance Sheet Statistics:

• annual data for the period 1997 to 2009
• values of the H-statistics and Lerner index were calculated for the whole period under analysis (1997-2009), and for three sub-periods: 1997-2001 (H₁), 2002-2007 (H₂) and 2008-2009 (H₃)

From BankScope Data:

• annual data for the period 2002 to 2009 for the Czech Republic, Hungary, Slovakia, Slovenia, Poland
• values of the H-statistics were calculated for the whole period under analysis (2002-2009), and for sub-periods: 2002-2007 (H₁), 2008-2009 (H₂)

Diff.-in-diff. Estimation

Two variants of the dependent variable equation were estimated: The first variant was based on the natural logarithm of interest income divided by total assets (II/TA), the second on the natural logarithm of interest income (II)
Revenue Equation for the Polish Banking Sector Panzar and Rosse (P-R) model

\[ \ln(II_{it}) = C_i + a_1 \ln w_{lt} + a_2 \ln w_{pt} + a_3 \ln w_{kt} + d \times (OI/II) + e \times oth_{it} + \varepsilon_{it} \] (9)

- **II** – dependent variable
  - \((II/TA)\) - interest income/total assets or interest income
  - \((II)\) - interest income

- **\(w_l\) – unit price of labour**
  - personnel expenses/total assets

- **\(w_p\) – unit price of funds**
  - interest expenses/total deposits

- **\(w_k\) – unit price of capital**
  - other expenses/fixed assets

- **\(OI/II\) – (the ratio of other income to interest income)**
  - the ratio of other income to interest income

- **oth – bank specific variables**
  - size of nonperforming loans

- **\(c_i\) - constant**
  - constant

### Value of H-statistic for Polish Commercial Banks

#### Estimations results with time interaction terms for overall sample:

<table>
<thead>
<tr>
<th></th>
<th>FE</th>
<th></th>
<th>pooled OLS</th>
<th></th>
<th>GMM</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ln(II/TA)</td>
<td>ln(II)</td>
<td>ln(II/TA)</td>
<td>ln(II)</td>
<td>ln(II/TA)</td>
<td>ln(II)</td>
</tr>
<tr>
<td>(H_1) 1997 – 2001</td>
<td>0.55(^1)</td>
<td>-0.05(^2)</td>
<td>0.49(^1)</td>
<td>-0.597(^2)</td>
<td>0.60(^1)</td>
<td>-0.087(^2)</td>
</tr>
<tr>
<td>p(F-test)</td>
<td>(0.000)</td>
<td>(0.408)</td>
<td>(0.000)</td>
<td>(0.031)</td>
<td>(0.000)</td>
<td>(0.064)</td>
</tr>
<tr>
<td>(H_2) 2002 – 2007</td>
<td>0.78(^1)</td>
<td>0.281(^1)</td>
<td>0.79(^1)</td>
<td>-0.393(^2)</td>
<td>0.84(^1)</td>
<td>0.1745(^1)</td>
</tr>
<tr>
<td>p(F-test)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.537)</td>
<td>(0.000)</td>
<td>(0.045)</td>
</tr>
<tr>
<td>(H_3) 2008-2009</td>
<td>0.82(^1)</td>
<td>0.196(^3)</td>
<td>0.88(^1)</td>
<td>-0.769(^2)</td>
<td>0.82(^1)</td>
<td>-0.0348(^2)</td>
</tr>
<tr>
<td>p(F-test)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.000)</td>
<td>(0.635)</td>
<td>(0.000)</td>
<td>(0.045)</td>
</tr>
</tbody>
</table>

- \(H_0 : H = H_2\)
- \(H_0 : H = H_1\)
- \(H_0 : H = H_3\)

<table>
<thead>
<tr>
<th></th>
<th>FE</th>
<th></th>
<th>pooled OLS</th>
<th></th>
<th>GMM</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ln(II/TA)</td>
<td>ln(II)</td>
<td>ln(II/TA)</td>
<td>ln(II)</td>
<td>ln(II/TA)</td>
<td>ln(II)</td>
</tr>
<tr>
<td>(H^*) 1997 – 2007</td>
<td>0.76(^1)</td>
<td>0.015(^2)</td>
<td>0.73(^1)</td>
<td>0.006(^2)</td>
<td>0.67(^1)</td>
<td>-0.011(^2)</td>
</tr>
<tr>
<td>p(F-test)</td>
<td>(0.000)</td>
<td>(0.854)</td>
<td>(0.000)</td>
<td>(0.393)</td>
<td>(0.000)</td>
<td>(0.053)</td>
</tr>
<tr>
<td>(H) 1997 – 2009</td>
<td>0.77(^1)</td>
<td>0.126(^2)</td>
<td>0.74(^1)</td>
<td>-0.688(^2)</td>
<td>0.67(^1)</td>
<td>-0.0968(^2)</td>
</tr>
<tr>
<td>p(F-test)</td>
<td>(0.000)</td>
<td>(0.068)</td>
<td>(0.000)</td>
<td>(0.395)</td>
<td>(0.000)</td>
<td>(0.054)</td>
</tr>
</tbody>
</table>

Source: own calculations. Note: to test the value of \(H\) the Wald tests were used:

- For monopoly: \(H_0 : H \leq 0\) versus \(H_1: H > 0\)
- For perfect competition: \(H_0 : H = 1\) versus \(H_1: H \neq 1\)

\(^1\)Null hypothesis \(H=0\) and \(H=1\) has been rejected at 1% significance level.

\(^2\)Hypothesis of \(H \leq 0\) was not rejected at the significance level of 1%.
### Results of H-Statistic Based on the BankScope Data

#### Value of H-statistic for the Polish banking sector

<table>
<thead>
<tr>
<th>Source</th>
<th>Year</th>
<th>Value of H-statistic</th>
<th>The dependent variable</th>
<th>Number of banks</th>
<th>Market Structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claessens and Laeven (2004)</td>
<td>1994-2001</td>
<td>0.77(^1)</td>
<td>ln(II/TA)</td>
<td>40</td>
<td>Monopolistic competition</td>
</tr>
<tr>
<td>Gelos and Roldos (2002)</td>
<td>1994</td>
<td>0.54(^1)</td>
<td>ln(II/TA)</td>
<td>55</td>
<td>Monopolistic competition</td>
</tr>
<tr>
<td>Gelos and Roldos (2002)</td>
<td>1999</td>
<td>0.53(^1)</td>
<td>ln(II/TA)</td>
<td>55</td>
<td>Monopolistic competition</td>
</tr>
<tr>
<td>Yildrim and Philippatoas (2007)</td>
<td>1993-2000</td>
<td>0.50(^1)</td>
<td>ln(II/TA)</td>
<td>53</td>
<td>Monopolistic competition</td>
</tr>
<tr>
<td>Bikker and Spierdijk (2008)</td>
<td>1992</td>
<td>0.45(^1)</td>
<td>ln(II)</td>
<td>50</td>
<td>Monopolistic competition</td>
</tr>
<tr>
<td>Bikker and Spierdijk (2008)</td>
<td>2004</td>
<td>0.08</td>
<td>ln(II)</td>
<td>50</td>
<td>-</td>
</tr>
<tr>
<td>Bikker and Spierdijk (2011)</td>
<td>1994-2004</td>
<td>0.83</td>
<td>ln(II/TA)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bikker and Spierdijk (2011)</td>
<td></td>
<td>-0.19</td>
<td>ln(II)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Pawłowska (2005)</td>
<td>1997-2002</td>
<td>0.77(^1)</td>
<td>ln(II/TA)</td>
<td>All</td>
<td>Monopolistic competition</td>
</tr>
<tr>
<td>Pawłowska (2011)</td>
<td>1997-2007</td>
<td>0.76</td>
<td>ln(II/TA)</td>
<td>All</td>
<td>Monopolistic competition</td>
</tr>
<tr>
<td>Pawłowska (2011)</td>
<td>1997-2007</td>
<td>0.015</td>
<td>ln(II)</td>
<td>All</td>
<td>-</td>
</tr>
</tbody>
</table>


\(^1\)H=0 and H=1 rejected (level of confidence 99.9 per cent).
## Results of the calculation of the H statistic for EU-15 and EU-10

<table>
<thead>
<tr>
<th>Years:</th>
<th>Dependent variable</th>
<th>EU-15</th>
<th>EU-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998-2002(^1)</td>
<td>$\ln(II/TA)$</td>
<td>H = 0.54</td>
<td>H = 0.78</td>
</tr>
<tr>
<td>1998-2002(^1)</td>
<td>$\ln(TI/TA)$</td>
<td>H = 0.61</td>
<td>H = 0.46</td>
</tr>
<tr>
<td>1994(^2)</td>
<td>$\ln(II)$</td>
<td>H = 0.87</td>
<td>H = 0.61</td>
</tr>
<tr>
<td>2004(^2)</td>
<td>$\ln(II)$</td>
<td>H = 0.55</td>
<td>H = 0.55</td>
</tr>
</tbody>
</table>

## Value of H-statistic for banking sectors in CEC5 countries (BankScope)

<table>
<thead>
<tr>
<th>Estimations results with time interaction terms for overall sample:</th>
<th>Czech Republic</th>
<th>Hungary</th>
<th>Slovakia</th>
<th>Slovenia</th>
<th>Poland</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₁</td>
<td>2002 – 2007</td>
<td>0.28</td>
<td>0.34</td>
<td>0.19</td>
<td>0.27</td>
</tr>
<tr>
<td>H₂</td>
<td>2008 – 2009</td>
<td>0.07</td>
<td>0.003</td>
<td>0.11</td>
<td>-0.012</td>
</tr>
<tr>
<td>p(F-test)</td>
<td>H₀: H₁ = H₂</td>
<td>(0.037)</td>
<td>(0.000)</td>
<td>(0.612)</td>
<td>(0.034)</td>
</tr>
<tr>
<td>H</td>
<td>2002 – 2009</td>
<td>-0.25</td>
<td>0.35</td>
<td>0.28</td>
<td>0.30</td>
</tr>
</tbody>
</table>

| Dependent variable: Interest Income/ Total Assets |
|---|---|---|---|---|---|

<table>
<thead>
<tr>
<th>Estimations results with time interaction terms for overall sample:</th>
<th>Czech Republic</th>
<th>Hungary</th>
<th>Slovakia</th>
<th>Slovenia</th>
<th>Poland</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₁</td>
<td>2002 – 2007</td>
<td>0.48</td>
<td>0.85</td>
<td>0.85</td>
<td>0.44</td>
</tr>
<tr>
<td>H₂</td>
<td>2008 – 2009</td>
<td>0.38</td>
<td>0.98</td>
<td>0.76</td>
<td>0.39</td>
</tr>
<tr>
<td>p(F-test)</td>
<td>H₀: H₁ = H₂</td>
<td>(0.290)</td>
<td>(0.526)</td>
<td>(0.276)</td>
<td>(0.851)</td>
</tr>
<tr>
<td>H</td>
<td>2002 – 2009</td>
<td>0.43</td>
<td>0.55</td>
<td>0.70</td>
<td>0.53</td>
</tr>
</tbody>
</table>

Source: own calculations.
Lerner index in the case of banking companies (1)

The marginal cost is estimated on the basis of the following translogarithmic cost function (Berger & Mester (1997)):

$$\ln TC = \beta_0 + \beta_1 \ln y + 1/2 \beta_2 (\ln y)^2 + \sum_{j=1}^{3} \beta_j \ln W_j + \sum_{j=1}^{3} \sum_{k=1}^{3} \beta_{jk} \ln W_j \ln W_k + \sum_{j=1}^{3} \gamma_j \ln y \ln W_j + v_{it} + z_i$$

From the translog functional form marginal cost is easily derived from derivative:

$$MC = \frac{TC}{y} \left( \beta_1 + \beta_2 (\ln y_{it}) + \sum_{j=1}^{3} \gamma_j \ln W_j \right)$$

(10)

Lerner Index:

$$L = \frac{P - MC}{P}$$

price $p_i =$ interest income / total assets (Angelini i Cetorelli (2003)); $Y_i$ total assets, $W_j$ the price of the factors of production, $w1 =$ price of labour: personnel costs / total assets, $w2 =$ price of physical capital: operating costs (except personnel costs)/ fixed assets, $w3 =$ price of deposits: financial costs / deposits like in P-R model.
## Value of Lerner Indices for Polish Commercial Banks in 1997-2009

<table>
<thead>
<tr>
<th>Year</th>
<th>Std. Dev.</th>
<th>Lerner index</th>
<th>Std. Dev.</th>
<th>MC</th>
<th>Number of obs.</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.4222222</td>
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Source: own analysis.

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<tr>
<th>Years</th>
<th>Lerner index</th>
<th>Std. Dev.</th>
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<tr>
<td>(1) L₁: 1997-2001</td>
<td>0.3556355</td>
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<td>(2) L₂: 2002-2007</td>
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<td>H₀: L₁= L₂</td>
<td>p(F-test)</td>
<td>(0.0096)</td>
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<tr>
<td>H₀: L₃= L₁</td>
<td>p(F-test)</td>
<td>(0.0014)</td>
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<tr>
<td>H₀: L₃= L₂</td>
<td>p(F-test)</td>
<td>(0.2351)</td>
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Source: own analysis.
### Spearman's rank correlation coefficients matrix for Polish Commercial Banks in 1997-2009

<table>
<thead>
<tr>
<th>Correlation</th>
<th>Banks with majority foreign equity (with branches of foreign banks)</th>
<th>Banks with majority of state ownership</th>
<th>CR5</th>
<th>HHI</th>
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<tbody>
<tr>
<td>Lerner index</td>
<td>-0.3330</td>
<td>0.0879</td>
<td>-0.7345</td>
<td>-0.5055</td>
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</tbody>
</table>

Source: own analysis.
The Boone indicator model

The market shares of banks with lower marginal costs are expected to increase, and this $\beta$ is negative Boone et al. (2004).

$$\ln s_{it} = \alpha + \beta \ln mc_{it} + u_{it}$$

$s_i$ -market share, defined as $= q_i / \Sigma j q_j$

$MC_{it}$ -marginal cost of bank $i$ $t$,

$\beta$ parameter is referred to as the Boone indicator.

The stronger competition is, the stronger this effect will be, and the larger, in absolute terms, the (negative) value of $\beta$. 
Boone Indicators for Polish Commercial Banks and for Selected European Banking Sectors

Source: Leuvensteijn, Bikker, Rixtel, Sørensen (2007), for Poland own analysis. The results for 2009 are tentative.
Conclusions

• There was monopolistic competition in Polish banking sector between 2002-2007. The degree of competition in the Polish banking sector prior the crisis was close to that in the euro area banking sectors

• The main impulse for the increase in the level of competition in the Polish banking sector prior the crisis was the entry of foreign banks (which brings new technologies and new products), connected with the M&A process and a rapid growth of IT technology. This proces was connected with Poland’s accession to the European Union

• The same channels, consolidation and financial deregulation, that were observed in the EU during adoption of the euro, influenced the level of competition of the Polish banking sector
Conclusions, continued

- Between 2008 and 2009 the Polish banking system was mainly under the impact of the financial crisis, competition measures confirm that the degree of competition in the Polish banking sector *during the crisis* decreased slightly.

- Finally, liberalisation had an impact on the competition of the financial intermediaries and also on the financial crisis, while strong institutional environment and regulation reduces them. This suggest that coordinating regulation and competition policy is necessary (see: Vives, 2010).
REFERENCES


REFERENCES, continued

REFERENCES, continued


• Pawłowska M., *Competition in the Polish banking market prior to the recent crisis - empirical results obtained with the use of three different models for the period 1997-2007*, Bank i Kredyt, nr 5, 2011.


• Vieves X., *Competition and stability in banking*, CEPR, No. 50, August 2010.

Thank you for attention