

Supplementary Appendix

Determinants of banks' net interest margin: evidence from the Euro Area during the crisis and post-crisis period

This supplementary appendix reports the pair-correlation matrix (Table S1), descriptive statistics showing the trend of non-traditional activities, efficiency levels, operating costs as well as the evolution of the short-term money market rate over time (Figures S1, S2). Pooled and static instrumental variable regressions of the models are reported (Tables S2, S3). Finally, we present a focus on the measurement of market power with the use of the Lerner index.

A. Supplementary Tables and Figures

Table S1. – Pairwise correlation matrix.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) Lerner index	1.00									
(2) HHI	-0.01	1.00								
(3) Money makt int rate	-0.06	-0.07	1.00							
(4) Yield curve slope	-0.02	0.37	0.09	1.00						
(5) Interest rate risk	-0.01	0.00	-0.15	-0.03	1.00					
(6) Capitalization	0.05	0.07	-0.10	0.13	0.02	1.00				
(7) Average costs	-0.17	0.00	0.19	0.09	0.02	0.04	1.00			
(8) Efficiency	0.47	0.05	-0.13	0.02	0.00	0.22	-0.33	1.00		
(9) Non-traditional activity	-0.03	0.01	-0.01	-0.00	-0.00	0.00	0.09	0.03	1.00	
(10) Size	0.05	0.14	-0.01	0.03	0.00	-0.23	-0.11	0.03	-0.02	1.00
(11) Loan loss reserves	0.00	0.24	-0.15	0.43	0.02	0.04	0.08	0.05	-0.01	0.11
(12) Implicit interest payments	-0.28	-0.15	0.08	-0.05	-0.01	0.00	0.27	-0.54	-0.15	-0.31
(13) Reserves	-0.05	0.14	0.02	-0.01	0.00	0.05	0.05	-0.01	0.13	0.00
(14) Capital regulation	0.03	-0.20	-0.10	-0.47	0.00	-0.11	0.03	0.03	-0.01	0.08
(15) Supervisory power	0.05	0.03	-0.31	0.11	0.02	0.12	-0.12	0.14	0.01	-0.02
(16) Moral hazard	0.02	-0.20	0.02	-0.09	0.00	0.01	0.07	0.00	-0.04	-0.03
(17) GDP growth	0.04	-0.04	-0.14	-0.41	-0.39	-0.03	-0.13	0.08	0.02	-0.01
(18) Unemployment	0.01	0.38	-0.06	0.67	0.02	0.09	0.01	0.09	-0.01	0.11
(19) Inflation	-0.01	0.06	0.19	0.15	-0.14	0.03	-0.06	-0.02	0.00	0.00
(20) Branches	0.01	-0.57	0.11	-0.32	-0.02	-0.06	0.03	-0.04	-0.06	-0.02
	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
(11) Loan loss reserves	1.00									
(12) Implicit interest payments	0.00	1.00								
(13) Reserves	0.00	-0.04	1.00							
(14) Capital regulation	-0.16	0.02	0.09	1.00						
(15) Supervisory power	0.22	-0.13	0.00	0.05	1.00					
(16) Moral hazard	0.01	0.15	-0.07	0.36	-0.20	1.00				
(17) GDP growth	-0.12	-0.02	0.04	0.26	0.16	0.01	1.00			
(18) Unemployment	0.36	-0.14	-0.02	-0.12	0.04	-0.10	-0.28	1.00		
(19) Inflation	-0.02	0.02	0.00	-0.04	0.38	-0.22	0.29	-0.11	1.00	
(20) Branches	-0.16	0.20	-0.14	0.53	-0.29	0.66	0.02	-0.06	-0.16	1.00

Notes: The Table reports pair-wise Pearson correlation coefficients among the explanatory variables of net interest margin, computed on the estimation sample.

Table S2. – Determinants of the net interest margin (IV regressions).

	Model a)	Model b)	Model c)	Model d)
Lerner index	0.0248** (0.0104)	0.0248** (0.0104)	0.0247** (0.0103)	0.0247** (0.0104)
Short term interest rate	0.0003 (0.0018)	0.0071 (0.0082)	0.0003 (0.0018)	0.0071 (0.0082)
Short term interest rate ²		-0.0042 (0.0040)		-0.0042 (0.0040)
Yield curve slope	0.0004 (0.0002)	0.0006 (0.0004)	0.0004 (0.0003)	0.0006 (0.0004)
Yield curve slope ²		-0.0000 (0.0000)		-0.0000 (0.0000)
Interest rate risk	0.0003 (0.0005)	-0.0012 (0.0009)	0.0006 (0.0005)	-0.0010 (0.0011)
Capitalisation	0.0135*** (0.0046)	0.0140*** (0.0047)	0.0135*** (0.0046)	0.0140*** (0.0047)
Average costs	0.1137* (0.0662)	0.1117 (0.0684)	0.1138* (0.0665)	0.1118 (0.0687)
Efficiency	0.0074 (0.0089)	0.0074 (0.0089)	0.0075 (0.0089)	0.0075 (0.0089)
Non-traditional activity	-0.0009 (0.0028)	-0.0009 (0.0028)	-0.0009 (0.0028)	-0.0009 (0.0028)
Size	-0.0004 (0.0005)	-0.0004 (0.0006)	-0.0004 (0.0005)	-0.0004 (0.0006)
Loan loss reserves	0.0279*** (0.0075)	0.0273*** (0.0076)	0.0332*** (0.0106)	0.0322*** (0.0113)
Loan loss reserves * interest rate risk			-0.0169 (0.0233)	-0.0156 (0.0242)
Implicit interest payments	0.6442* (0.3715)	0.6461* (0.3736)	0.6438* (0.3729)	0.6457* (0.3751)
Reserves	0.0121 (0.0406)	0.0114 (0.0413)	0.0121 (0.0407)	0.0114 (0.0415)
Cooperative banks	0.0005 (0.0016)	0.0005 (0.0016)	0.0005 (0.0016)	0.0005 (0.0016)
Savings banks	0.0007 (0.0014)	0.0007 (0.0014)	0.0007 (0.0014)	0.0007 (0.0014)
Capital stringency	-0.0001 (0.0005)	-0.0001 (0.0005)	-0.0001 (0.0005)	-0.0001 (0.0005)
Supervisory power	-0.0001 (0.0001)	-0.0001 (0.0001)	-0.0001 (0.0001)	-0.0001 (0.0001)
Moral hazard	-0.0003 (0.0003)	-0.0005 (0.0004)	-0.0003 (0.0003)	-0.0005 (0.0004)
GDP growth	0.0002 (0.0004)	0.0003 (0.0003)	0.0002 (0.0004)	0.0003 (0.0003)
Unemployment	-0.0001* (0.0001)	-0.0002** (0.0001)	-0.0001* (0.0001)	-0.0002** (0.0001)
Inflation	0.0002 (0.0006)	-0.0002 (0.0009)	0.0002 (0.0006)	-0.0002 (0.0010)
Branches	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
Intercept	-0.0019 (0.0210)	-0.0026 (0.0216)	-0.0021 (0.0210)	-0.0028 (0.0215)

Time dummies	Yes [0.000]	Yes [0.000]	Yes [0.000]	Yes [0.000]
Number of observations	12947	12947	12947	12947

Notes: the dependent variable is the net interest margin. OLS results are estimated on the unbalanced full sample. Robust standard errors are reported in brackets. We address the endogeneity of the Lerner index and Non-traditional activity through instrumental variables regressions using the second lags as an instrument. *, **, *** denote significance at 1, 5, 10%, respectively.

Table S3. – Determinants of the net interest margin (static model).

	Model a)	Model b)	Model c)	Model d)
Lerner index	-0.0058 (0.0084)	-0.0059 (0.0085)	-0.0058 (0.0083)	-0.0059 (0.0084)
Short term interest rate	0.0011*** (0.0002)	0.0024 (0.0023)	0.0011*** (0.0002)	0.0023 (0.0023)
Short term interest rate ²		-0.0007 (0.0015)		-0.0007 (0.0015)
Yield curve slope	0.0001 (0.0001)	0.0005* (0.0003)	0.0001 (0.0001)	0.0005* (0.0003)
Yield curve slope ²		-0.0000*** (0.0000)		-0.0000*** (0.0000)
Interest rate risk	-0.0001 (0.0002)	-0.0001 (0.0004)	0.0001 (0.0002)	0.0000 (0.0004)
Capitalisation	0.0201*** (0.0052)	0.0199*** (0.0052)	0.0202*** (0.0052)	0.0200*** (0.0052)
Average costs	0.0301 (0.0229)	0.0308 (0.0235)	0.0297 (0.0228)	0.0304 (0.0234)
Efficiency	0.0219*** (0.0059)	0.0219*** (0.0059)	0.0219*** (0.0058)	0.0219*** (0.0059)
Non-traditional activity	0.0000 (0.0001)	0.0000 (0.0001)	0.0000 (0.0001)	0.0000 (0.0001)
Size	0.0004 (0.0002)	0.0004 (0.0002)	0.0004 (0.0002)	0.0004 (0.0003)
Loan loss reserves	0.0037 (0.0051)	0.0039 (0.0052)	0.0074 (0.0057)	0.0066 (0.0057)
Loan loss reserves * interest rate risk			-0.0106* (0.0055)	-0.0076 (0.0058)
Implicit interest payments	0.4958*** (0.0818)	0.4925*** (0.0833)	0.4965*** (0.0813)	0.4931*** (0.0829)
Reserves	0.0006 (0.0031)	0.0005 (0.0030)	0.0007 (0.0031)	0.0005 (0.0030)
Capital stringency	-0.0002* (0.0001)	-0.0002* (0.0001)	-0.0002* (0.0001)	-0.0002* (0.0001)
Supervisory power	-0.0000 (0.0001)	-0.0000 (0.0001)	-0.0000 (0.0001)	-0.0000 (0.0001)
Moral hazard	-0.0005** (0.0002)	-0.0004* (0.0002)	-0.0005** (0.0002)	-0.0004* (0.0002)
GDP growth	-0.0001* (0.0001)	-0.0001 (0.0001)	-0.0001* (0.0001)	-0.0001 (0.0001)
Unemployment	0.0002*** (0.0001)	0.0001 (0.0001)	0.0002*** (0.0001)	0.0001 (0.0001)
Inflation	0.0004*** (0.0001)	0.0002 (0.0002)	0.0004*** (0.0001)	0.0002 (0.0002)
Branches	0.0000** (0.0000)	0.0000** (0.0000)	0.0000** (0.0000)	0.0000** (0.0000)
Intercept	-0.0242*** (0.0071)	-0.0236*** (0.0072)	-0.0245*** (0.0071)	-0.0238*** (0.0072)
Time dummies	Yes [0.000]	Yes [0.000]	Yes [0.000]	Yes [0.000]
Hausman test	1547.67 [0.000]	1591.95 [0.000]	1546.85 [0.000]	1587.91 [0.000]
Number of observations	12947	12947	12947	12947

Notes: the dependent variable is the net interest margin. Results with individual fixed effects are estimated on the unbalanced full sample. The Hausman test is presented at the bottom of the table, whose Chi-squared and p -value in square brackets show the necessity of using fixed effects, GLS estimator being inconsistent. We address the endogeneity of the Lerner index and Non-traditional activity through instrumental variables regressions using the second lags as an instrument. *, **, *** denote significance at 1, 5, 10%, respectively.

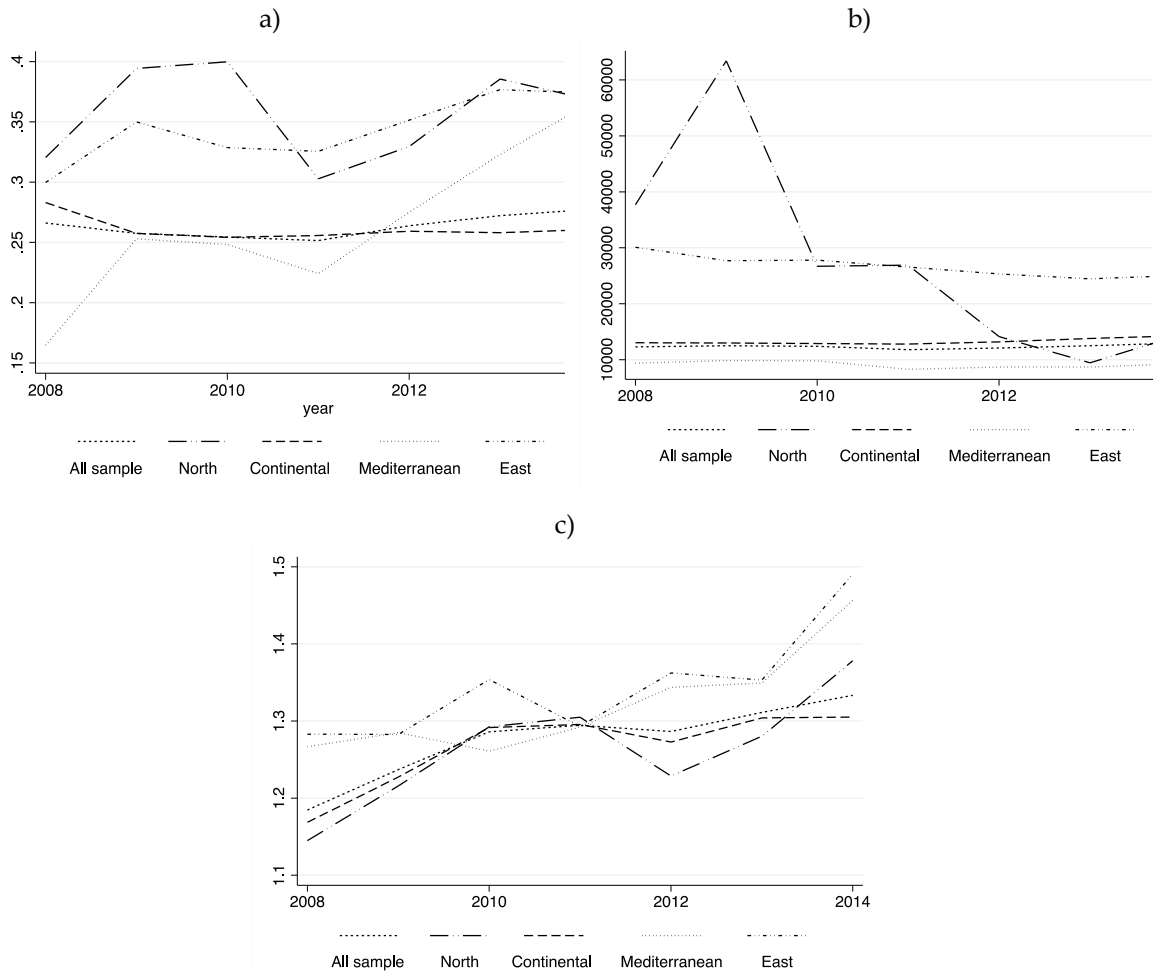


Figure S1. Trends of non-traditional activities, operating costs and efficiency. Notes: The figure displays the trends of median values of non-traditional activities (panel a)), operating costs (panel b)) and efficiency (panel c)), disaggregated by macro-region over the period 2008-2014). Non-traditional activities are the ratio of net non-interest income to net operating income. Operating costs are expressed in thousands of Euros. Efficiency is the ratio of gross income to operating costs. Geographical areas are grouped as follows. North includes Finland, the Netherlands and Ireland. East comprehends Estonia, Latvia, Lithuania, Slovakia and Slovenia. Continental groups Austria, Belgium, France, Germany and Luxembourg. Mediterranean includes Italy, Spain, Portugal, Greece, Malta and Cyprus. Sources: Authors' elaboration on BankScope data.

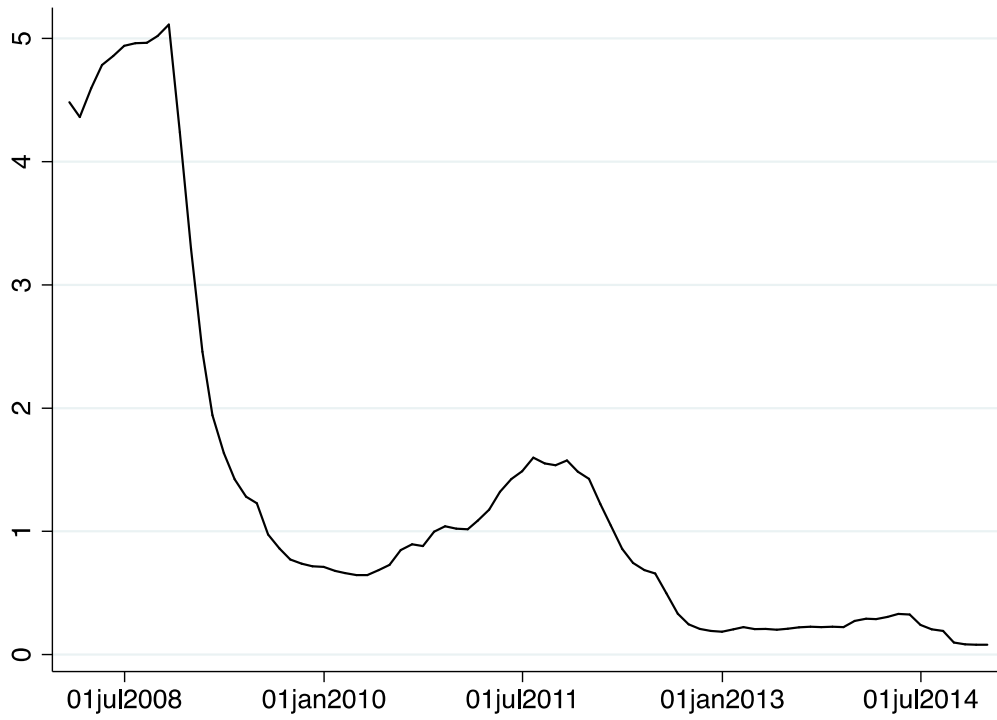


Figure S2. Three-month short-term interbank market rate (Euribor). Notes: The figure displays the monthly trend of the three months interbank market rate (Euribor) over the period 2008-2014. Sources: Authors' elaboration on ECB data.

B. Measuring market power using the Lerner Index

Usually, literature uses the common Herfindahl–Hirschman index as a country-level proxy of the degree of concentration in the banking system. This index is defined as the sum of the squares of the market shares. It is based on the assumption that competition takes place on a national scale. Alternatively, Lerner index offers a more specific bank-level proxy of market power. It measures banks' ability to set prices above the marginal cost. It is defined as the difference between the price and the marginal cost, divided by the price. Theoretically, the values of the index range from 0, in the case of perfect competition, to 1 when there is a condition of monopoly. Empirically, the procedure for constructing Lerner index is based on the approach used in Fernández de Guevara et al. (2001), Maudos and Pérez (2003) and Maudos and Fernández de Guevara (2004). The product price is obtained as the ratio of total revenues (interest income and other operating incomes from the traditional activity) to total assets. In order to estimate the marginal cost for producing an additional unit of output, a translog function of banks' total costs (financial and operating) is used (Pulley and Braunstein, 1992).

$$\begin{aligned}
 \ln C_i = & \alpha_0 + \alpha_1 \ln TA_i + \frac{1}{2} \alpha_2 (\ln TA_i)^2 \\
 & + \sum_{j=1}^3 \beta_j \ln w_{ij} \\
 & + \frac{1}{2} \sum_{j=1}^3 \sum_{k=1}^3 \beta_{jk} \ln w_{ij} \ln w_{ik} \\
 & + \frac{1}{2} \sum_{j=1}^3 \gamma_j \ln TA_i \ln w_{ij} + \mu_i Trend + \frac{1}{2} \mu_2 Trend^2 + \mu_3 Trend \ln TA_i \\
 & + \sum_{j=1}^3 \lambda_j Trend \ln w_{ij} + \ln \mu_i
 \end{aligned} \tag{B1}$$

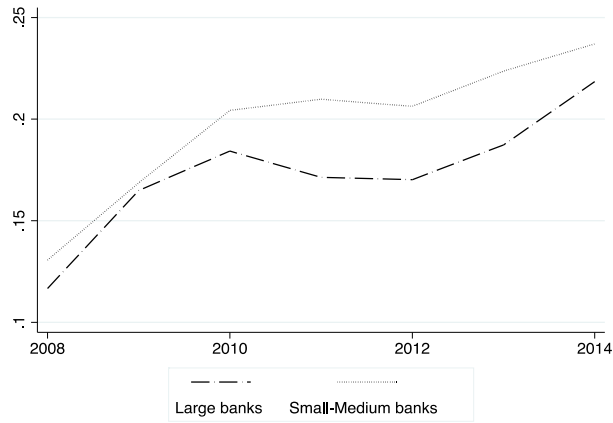
Total assets, TA_i , is the bank's output and w_{ij} is the price of the j -th input used in the production process. Specifically, the first input is the price of labor defined as the ratio of personnel costs to total assets. The price of physical capital is constructed as the ratio of operating costs, with the exception of personnel costs, to fixed assets. Thirdly, the price of deposits is retrieved as the ratio of financial costs to customer and short-term funding.

The estimation of the cost function includes fixed individual effects in order to take into account the bank-specific heterogeneity. The variable $Trend$ is a proxy of the technical changes, which may have modified the position of the cost function over time. We impose the canonical restrictions of symmetry and degree 1 homogeneity in the price of inputs.

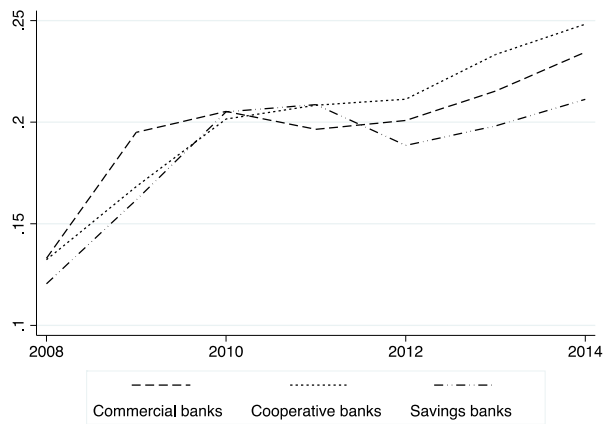
Using Equation (B.1), the marginal cost of bank i at time t can be calculated as:

$$\begin{aligned}
 MC_i = & \frac{CT_i}{TA_i} [\alpha_1 + \alpha_2 \ln TA_i + \gamma_{12} (\ln w_{i1} - \ln w_{i2}) + \gamma_{32} (\ln w_{i3} - \ln w_{i2}) \\
 & + \mu_3 Trend]
 \end{aligned} \tag{B2}$$

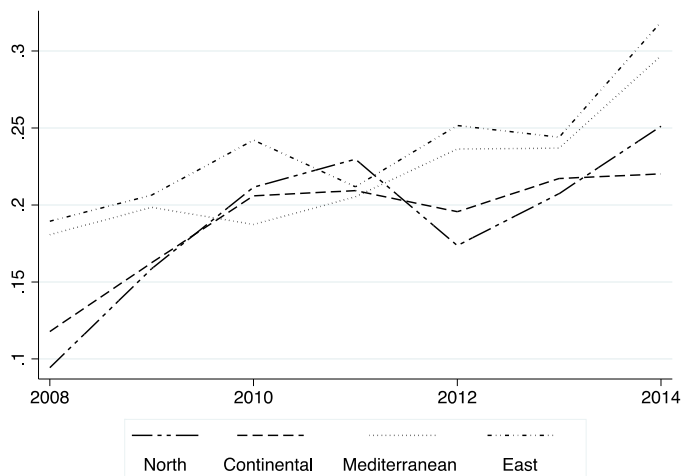
The evolution of our estimated Lerner index is shown in Figure B.1. The point estimates of the median values by bank specialization and size for each year are depicted. The figure reveals that market power substantially increased during the financial crisis, from 2008 until 2010, in the Euro Area. This increasing trend is confirmed also in the post crisis years with less steep patterns for cooperative and commercial banks, whereas a slight fluctuation is displayed in the case of savings institutions after 2011.



(a)



(b)



(c)

Figure S3. – Evolution of competition – Lerner index. Notes: The figure reports median values calculated by bank size (panel a)), specialization (panel b)) and country (panel c)) over the years (2008-2014). Institutions with total assets overcoming 10 billions were considered as large banks. Geographical areas are grouped as follows. North includes Finland, the Netherlands and Ireland. East comprehends Estonia, Latvia, Lithuania, Slovakia and Slovenia. Continental groups Austria, Belgium, France, Germany and Luxembourg. Mediterranean includes Italy, Spain, Portugal, Greece, Malta and Cyprus. Sources: Authors' elaboration from BvD BankScope data.

Interestingly, when we compare large intermediaries (total assets overcoming 10 billions) to medium-small banks, the evidence highlights an overall increase in the Lerner index until 2010. After

this year, large institutions seem to suffer from a slight reduction in market power until 2012, but later reverting newly the negative trend. Small-medium banks, instead, have never registered noticeable contraction in their competitiveness after 2008. Kick and Prieto (2013), focusing on the German banking system, depict a similar evolution for large and small banks, registering a turnaround during the crisis, followed by a sharp increase in market power after 2008. When we consider median values of the Lerner index by geographical area, Eastern and Mediterranean countries display the banking systems where market power is the highest, especially after 2011.

References

1. Fernández de Guevara, J., Maudos, J., Pérez, F., 2001. Market power in European banking sectors. *EC Working Paper 2002-05 IVIE*.
2. Kick, T., Prieto, E., 2013. Bank risk taking and competition: evidence from regional banking markets. *Bundesbank discussion paper*, No 30/2013.
3. Maudos, J., Fernández de Guevara, J., 2004. Factors explaining the interest margin in the banking sectors of the European Union. *Journal of Banking and Finance* 28, 2259-2281.
4. Maudos, J., Pérez, F., 2003. Competencia vs. poder de mercado en la banca española. *Moneda y Crédito* 217, 139-166.
5. Pulley, L.B., Braunstein, Y.M., 1992. A composite cost function for multiproduct firms with an application to economies of scope in banking. *The Review of Economics and Statistics* 74(2), 221-230.