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The Interaction between Competition and Stability in the Russian Banking System: A Panel Study

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Main questions of the study

- Two alternative concepts regarding the relationship between competition and stability:
  1) **competition-fragility** (franchise value paradigm, *Keeley (1990)*)

$$\uparrow COMPETITION \Rightarrow \downarrow market\ power\ \&\ \downarrow ROA \Rightarrow \downarrow bank\ franchise\ value \Rightarrow \uparrow bank\ risk\ taking$$

  2) **competition-stability** (risk-shifting paradigm, *Boyd & De Nicolo (2005)*)

$$\downarrow COMPETITION \Rightarrow \uparrow loan\ rates \Rightarrow \uparrow borrowers\ default\ risk \Rightarrow \uparrow NPL$$

  There is no consensus about the two concepts in literature.

- So how does it work in the Russian banking system? Should Bank of Russia provide measures aimed at increasing or decreasing banking competition?
- Non-linear relationship between competition and stability (*Martinez-Miera & Repullo (2010)*) – Are there any thresholds in competition dividing the two concepts in the Russian banking system?
- How robust are the result for Russian banking system to the choice of different competition and stability measures & estimation techniques?

Literature review

Relationship between competition and stability		
"Competition - Stability"	*"Competition - Fragility"*	*Non-linear*
	Keeley (1990) Hellmann, Murdock, Stiglitz (2000)	Allen, Gale (2004)*
Boyd, De Nicolo (2005) Boyd, De Nicolo, Jalal (2006) De Nicolo, Loukoianova (2006) Schaeck, Cihak, Wolfe (2006) Beck, Demirguc-Kunt, Levine (2006)	Hauswald, Marquez (2006)	
Carletti, Hartmann, Spagnolo (2007)	Levy Yeyati, Micco (2007)	**Martinez-Miera, Repullo (2007, 2010)**
	Jimenez, Lopez, Saurina (2007)	
Schaeck, Cihak (2007, 2008)	De Jonghe, Vennet (2008)	Berger, Klapper, Turk-Ariss (2008)
Koetter, Poghosyan (2009)	Fungachova, Weill (2011)	
Мамонов (2010)	Agoraki, Delis, Pasiouras (2011)	

Alternative measures of competition

- **Lerner index** (separately for loan and for deposit markets, *Fernandez de Guevara, Maudos (2004)*)

  $loan\ market\ (\ for\ individuals\ \&\ firms\ ):$

  $$LERNER_{it}^{LNS} = \left(r_{it}^{LNS} - MC_{it}^{LNS}\right) / r_{it}^{LNS}$$

  $$where\ \ r_{it}^{LNS} = \left(Interest\ \ Income\right)_{it}^{LNS} / \frac{1}{5} \cdot \sum_{j=0}^{5} LNS_{it-j};$$

  $$MC_{it}^{LNS} = AC_{it}^{LNS} \cdot \left(\alpha_1 + \beta_{11} \ln LNS_{it} + \beta_{12} \ln DEP_{it} + \gamma_{11} \ln P_{it}^{labor} + \gamma_{12} \ln P_{it}^{phys.cap}\right)$$

  $MC\ are\ calculated\ on\ the\ basis\ of\ SFA\ (Stochastic\ Frontier\ Approach)$

- **Herfindahl-Hirschman index** on bank level (*Berger, Hannan (1998)*) – reflects the degree of bank involvement into different markets of earning assets (EA) or earning liabilities (EL)

  $$HHI_{it}^{EA} = \frac{1}{M} \cdot \sum_{j=1}^{M} d_{it}^{(j)} \cdot EA_{it}^{(j)}, \quad where\ M\ is\ the\ number\ of\ markets$$

- **H-statistic**, *Panzar & Rosse (1987)*
- **Boone indicator**, *Boone (2001)*

Relationships testing

- **Panel regressions:**

$$STABILITY_{it} = f\left(COMPET_{it-j}, COMPET^2_{it-j} \cdot I_{sample}, BSF_{it-m}, MACRO_{it-n}\right) + \varepsilon_{it}$$

$$where\ \ j = 1...4,\ \ m,n = 0...4,\ \ COMPET_{it} = \left\{LERNER^{LNS}_{it},\ HHI^{EA}_{it}\right\}$$

$I_{sample} = 1\ if$ inflection point lies above at least 10^{th} percentile of sample & $0\ \ if$ else

- **Time-series regressions:**

$$STABILITY_t = f\left(COMPET_{t-j}, COMPET^2_{t-j} \cdot I_{sample}, BSF_{t-m}, MACRO_{t-n}\right) + \varepsilon_t$$

$$where\ \ j = 1...4,\ \ m,n = 0...4,\ \ COMPET_t = \left\{H\,stat_t,\ Boone_t\right\}$$

- **Measures of stability for both time-series & panel regressions:**

$$STABILITY = \left\{Overdue\ loans / Total\ loans,\ \ Z\,scores\right\},$$

$$where\ \ Z\,scores = \frac{EQ/TA + E(ROA)}{s.d.(ROA)},\quad Roy(1952)$$

Data source & sample of Russian banks

- Unconsolidated quarterly data on banks

  – assets & liabilities (form 101) (source: Bank of Russia);

  – revenues & expenses (form 102) (source: Bank of Russia).

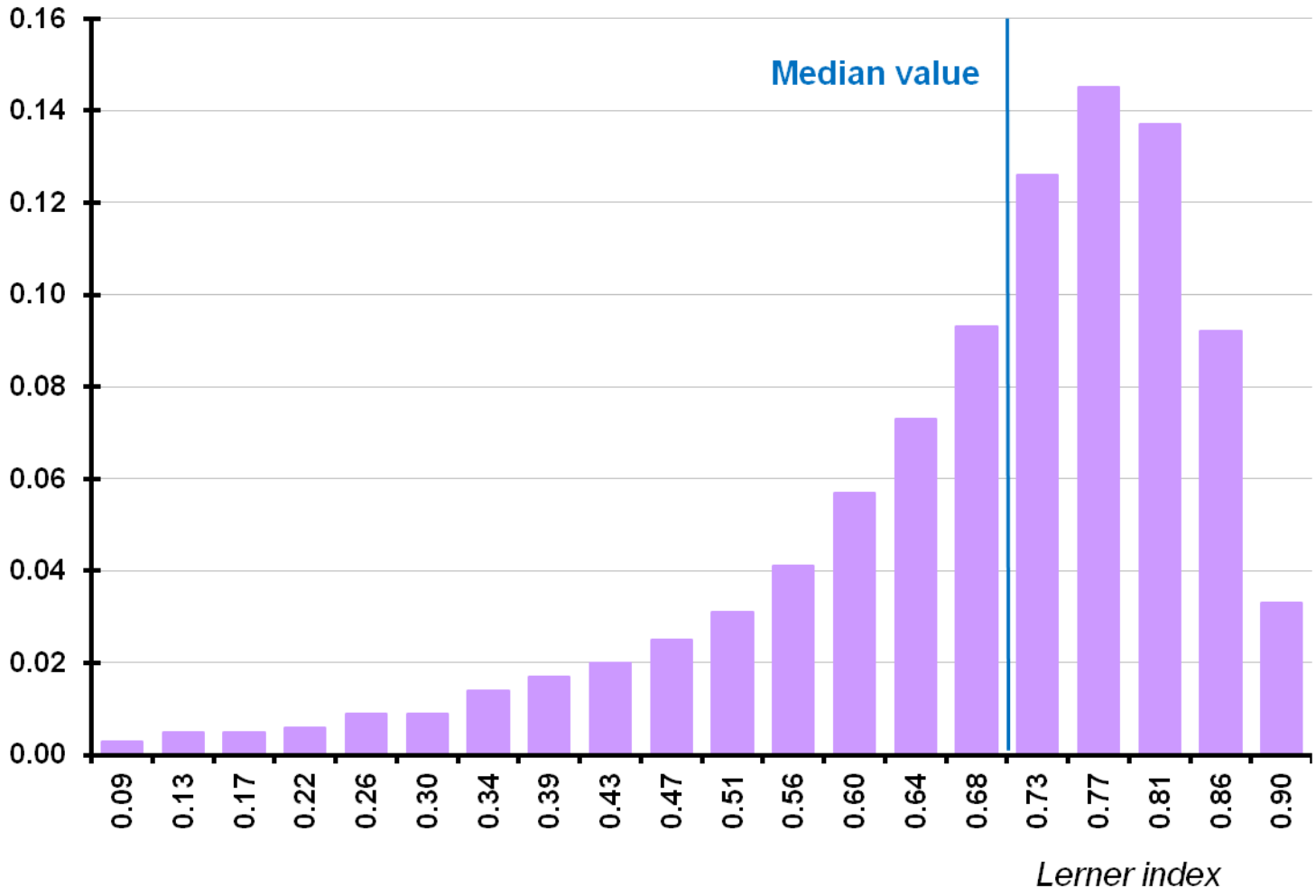
- Sample size: 521 banks, which were constantly operated in banking markets during 2004q1 – 2011q2 (covers 85% of total assets)

- Descriptive statistics for competition & stability measures:

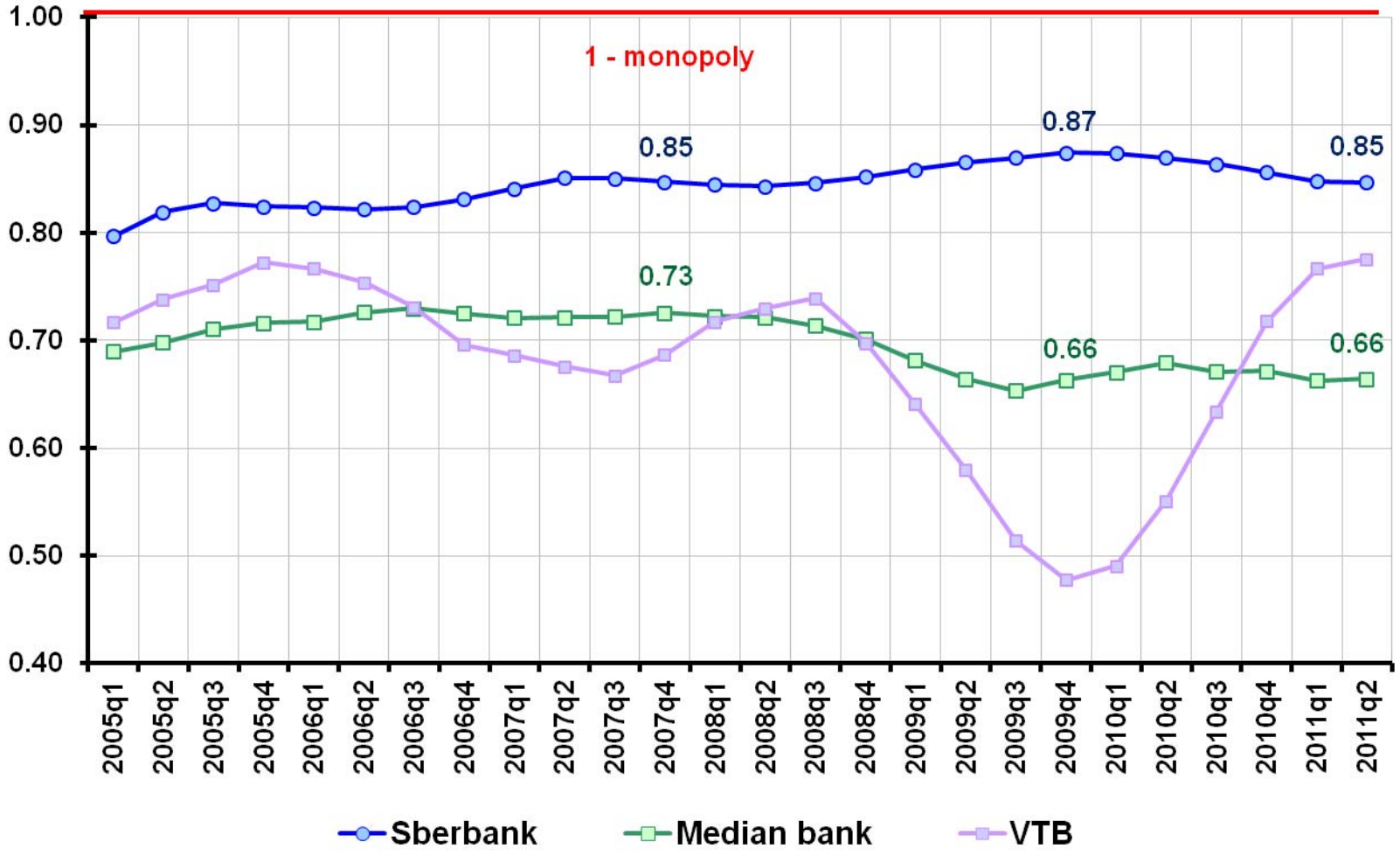
Variable	Obs	Mean	Std. Dev.	Min	Max
panel variables:					
LERNER	12586	0.60	0.44	-10.08	1.00
HHIea	15631	0.1192	0.0263	0.0065	0.3839
NPL	13605	0.032	0.055	0.000	1.000
Z-scores	11326	48.3	37.3	1.5	266.1
time variables:					
H-stat	27	0.70	0.09	0.45	0.84
Boone	15	-0.45	0.07	-0.51	-0.29
Z-scores (average)	22	81	29	39	138

Distribution density of loan market Lerner indices of Russian banks

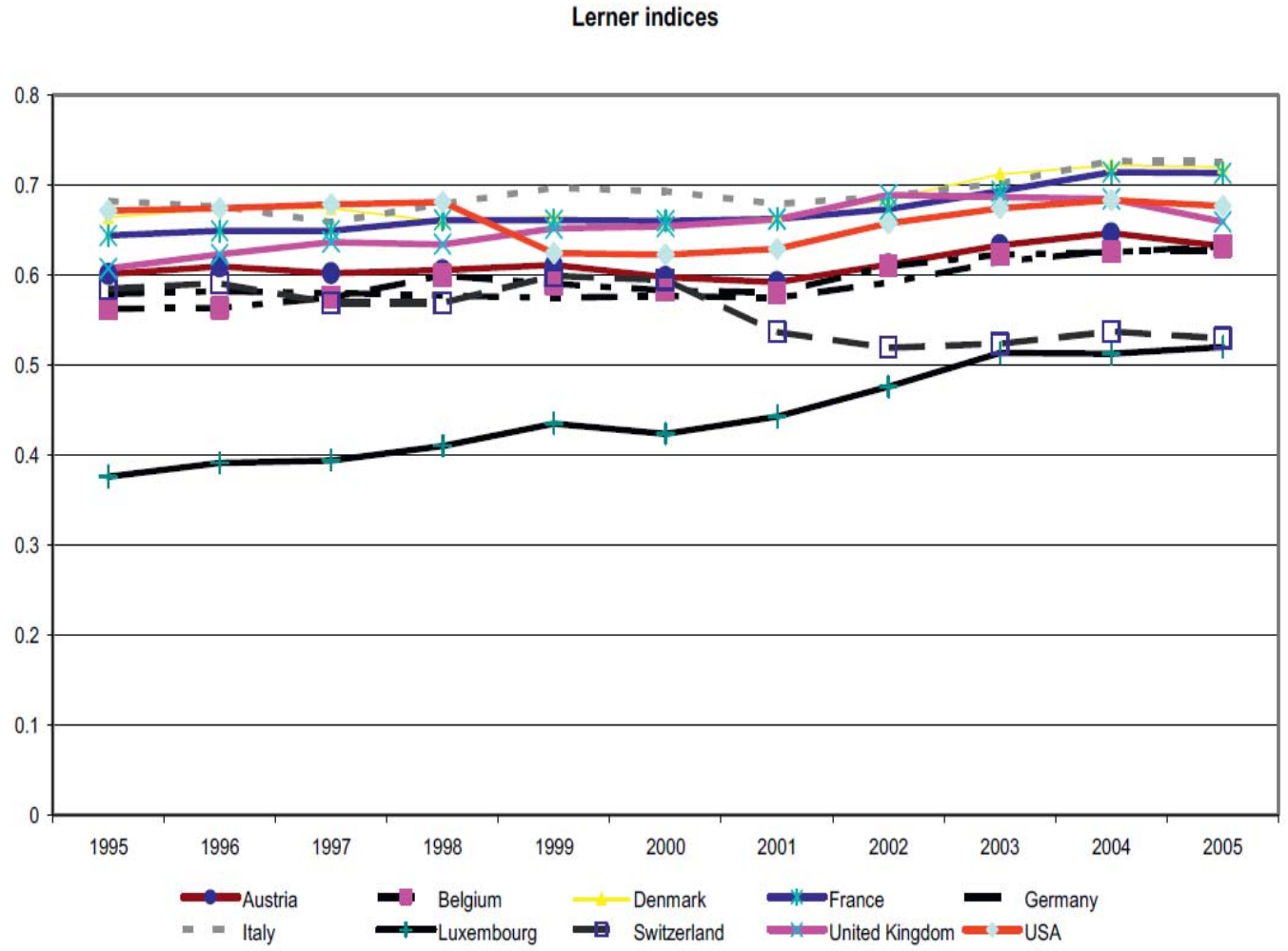
(average values during 2005q1 – 2011q2)



Loan market Lerner indices of Russian banks in dynamics



Lerner indices in different developed counties

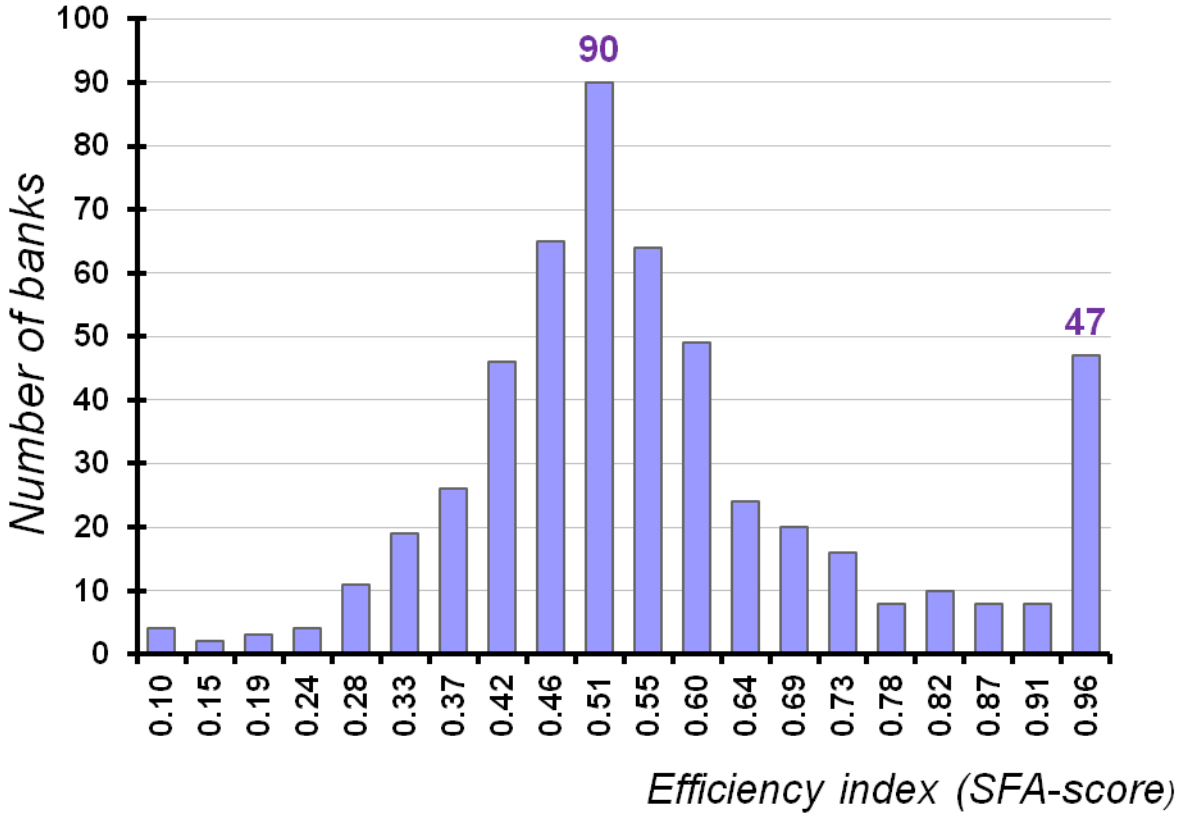


Source: Schaeck, Cihak (2008)

Preliminary version of estimated efficiency scores (SFA):

(average values during 2005q1 – 2011q2)

there is a group of the ultra-efficient banks (0.96). Some of them were absorbed by other banks (M&A) and many of them were faced with a license withdrawal …



Panel regression result №1: Lerner positively affects loan quality

(one-step GMM estimator)

	Independent variables	Dependent variable: Overdue loans / Total Loans			
		M1	M2	M3	M4
BSF	Overdue loans / Total Loans (lag = 1 quarter)	0.501*** (0.157)	0.511*** (0.158)	0.545*** (0.151)	0.434*** (0.127)
	Lerner Index (lag = 4 quarters)	–0.038*** (0.012)	–0.038*** (0.012)	–0.047*** (0.014)	–0.042*** (0.015)
	Loans / Total Assets	–0.235*** (0.068)	–0.232*** (0.068)	–0.246*** (0.073)	–0.350*** (0.103)
	Loans / Total Assets (squared)	0.191*** (0.059)	0.191*** (0.059)	0.192*** (0.060)	0.245*** (0.076)
	ROA (lag = 4 quarters)	–0.244* (0.127)	–0.260* (0.130)	–0.248* (0.135)	
MACRO	Real GDP growth (y-o-y, lag = 1 quarter)	–0.065*** (0.014)	–0.079*** (0.015)	–0.084*** (0.015)	–0.093*** (0.013)
	Volatility of exchange rate (RUR per bi-currency basket, lag = 1 quarter)	0.003*** (0.000)			
	Real loan interest rate	0.077** (0.036)	0.070** (0.036)		
	Number of observations	8198	8198	8198	8801
	Number of banks	489	489	489	489
	Number of instruments	444	443	442	442
	P-value Hansen	0.238	0.200	0.200	0.128
	P-value AR(1) / AR(2)	0.002 / 0.473	0.002 / 0.502	0.002 / 0.502	0.001 / 0.508
	Inflection point for Loans / Total Assets	0.62	0.68	0.64	0.71

** , **, *** denote an estimate significantly different from zero at the 10%, 5%, 1% level. Standard errors are in parentheses*

Competition - fragility

Panel regression result №2: another competition measure – the same result

(one-step GMM estimator)

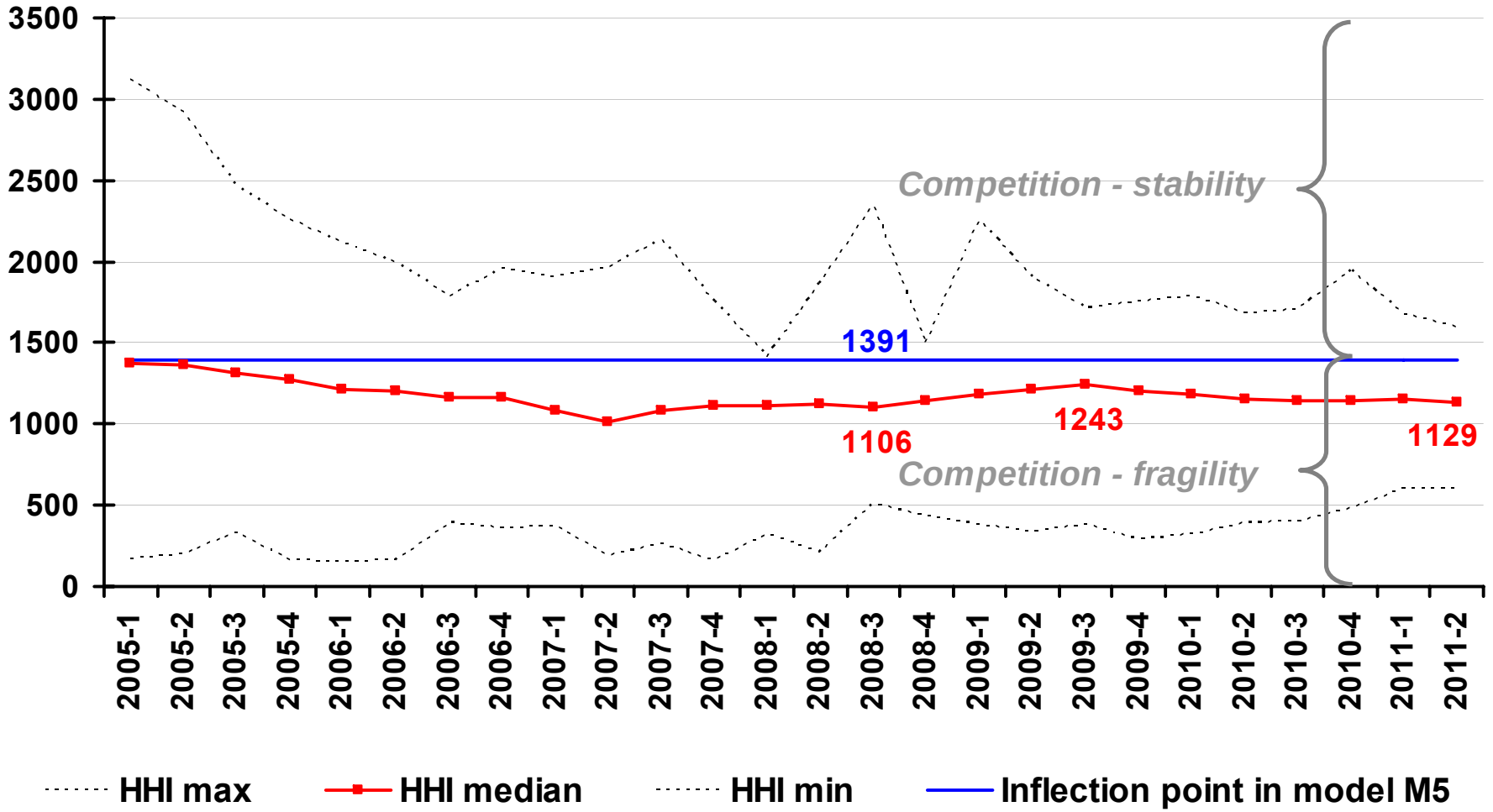
	Independent variables	Dependent variable: Overdue loans / Total Loans		
		M5	M6	M7
BSF	Overdue loans / Total Loans (lag = 1 quarter)	0.356*** (0.122)	0.375*** (0.122)	0.386*** (0.125)
	Bank-level HHI_{EA} (lag = 4 quarters)	–0.914*** (0.315)	–0.966*** (0.332)	–0.796** (0.328)
	Bank-level HHI_{EA} (lag = 4 quarters), squared	3.286*** (1.208)	3.299*** (1.265)	2.612** (1.254)
	Loans / Total Assets	–0.380*** (0.097)	–0.415*** (0.103)	–0.417*** (0.105)
	Loans / Total Assets (squared)	0.291*** (0.078)	0.317*** (0.082)	0.320*** (0.083)
	Operating cost / Total income	5.420** (2.402)		
MACRO	Real GDP growth (y-o-y, lag = 1 quarter)	–0.044*** (0.009)	–0.046*** (0.009)	–0.065*** (0.010)
	Volatility of exchange rate (RUR per bi-currency basket, lag = 1 quarter)	0.003*** (0.001)	0.004*** (0.000)	
	Real loan interest rate	0.173*** (0.038)	0.157*** (0.038)	0.149*** (0.038)
	Number of observations	10813	10965	10965
	Number of banks	498	499	499
	Number of instruments	510	510	509
	P-value Hansen	0.575	0.565	0.539
	P-value AR(1) / AR(2)	0.000 / 0.252	0.000 / 0.438	0.000 / 0.443
	Inflection point for bank-level HHI_{EA}	0.1390	0.1463	0.1524
	Inflection point for Loans / Total Assets	0.65	0.65	0.65

** , **, *** denote an estimate significantly different from zero at the 10%, 5%, 1% level. Standard errors are in parentheses*

The inflection point (0.1390) of the model M5 is approx. 86-th percentile of sample

Competition - fragility

Panel regression result №2: diagram of competition threshold



Panel regression result №3: another stability measure – still the same result *(fixed effects estimator)*

Lerner index positively affects aggregate banking stability (Z-score)

	Independent variables	Dependent variable: Z-score			
		M8	M9	M10	M11
BSF	Lerner Index (lag = 2 quarters)	5.756*** (1.071)	5.167*** (1.041)	4.292*** (0.997)	6.770*** (1.064)
BSF	Loans / Deposits (LTD ratio, lag = 4 quarters)	–1.285*** (0.334)	–1.084*** (0.321)		–1.184*** (0.336)
BSF	Liquid assets / Deposits (lag = 3 quarters)	2.887*** (0.977)			1.066** (0.543)
MACRO	Real GDP growth (y-o-y, lag = 1 quarter)	34.821*** (4.625)	35.584*** (4.617)	35.261*** (4.606)	
MACRO	Volatility of exchange rate (RUR per bi-currency basket, lag = 1 quarter)	–1.634*** (0.390)	–1.622*** (0.390)	–1.467*** (0.388)	
MACRO	Real interest rate on loans	–36.886*** (8.908)	–34.754*** (8.896)	–35.604*** (8.876)	
	Intercept	10.445** (4.949)	10.645** (4.935)	10.100** (4.890)	45.124** (0.837)
	Number of observations	10429	10479	10553	10435
	Number of banks	519	519	519	519
	Fixed effects	yes	yes	yes	yes
	R^2 adj.	0.498	0.497	0.494	0.491

** , **, *** denote an estimate significantly different from zero at the 10%, 5%, 1% level. Standard errors are in parentheses*

Competition - fragility

Panel regression result №4: determinants of competition
(fixed effects estimator)

	Independent variables	Dependent variable: Lerner Index			
		M12	M13	M14	M15
BSF	Operating cost / Total income (lag = 2 quarters)	–95.486*** (2.102)	–95.208*** (2.126)	–96.063*** (2.157)	–92.384*** (2.142)
BSF	Fee / Total income (lag = 1 quarter)	–0.566*** (0.046)			
BSF	Loans / Total assets (lag = 2 quarters)	0.246*** (0.021)	0.246*** (0.021)		
BSF	Real loans growth (y-o-y, lag = 2 quarters	0.001** (0.000)	0.001** (0.000)	0.000* (0.000)	
BSF	Share of banks assets in banking system total assets (in logarithms)	0.021*** (0.007)	0.026*** (0.007)	0.024*** (0.007)	0.034*** (0.007)
BSF	Equity / Total assets (lag = 1 quarter)	–0.306*** (0.035)	–0.262*** (0.037)	–0.274*** (0.038)	–0.275*** (0.035)
BSF	Loan loss provisions / Total assets (lag = 1 quarter)	–0.792*** (0.095)	–0.696*** (0.094)	–0.672*** (0.096)	–0.543*** (0.095)
MACRO	Moscow interbank actual credit rate (real MIACR, lag = 1 quarter)	–0.237** (0.112)		–0.355*** (0.108)	–0.167* (0.099)
MACRO	Real GDP growth (yearly rate, lag = 1 quarter)	0.141*** (0.042)	0.108*** (0.039)		
	Intercept	1.036*** (0.074)	1.062*** (0.077)	1.267*** (0.061)	1.348*** (0.056)
	Number of observations	11403	11404	11490	12406
	Number of banks	519	519	519	519
	Fixed effects	yes	yes	yes	yes
	R^2 adj.	0.688	0.683	0.669	0.642

** , **, *** denote an estimate significantly different from zero at the 10%, 5%, 1% level. Standard errors are in parentheses*

Conclusion

- Russian banking system is characterized by monopolistic competition, which is growing over time, showing a high sensitivity to the crisis of 2008-2009
- All estimators using different competition and stability measures supports traditional “competition – fragility” concept (franchise value paradigm) for Russian banking system;
- Nevertheless, there is an optimal threshold in banking competition above which the sign of the relationship between competition and stability changes from plus to minus;
- Both the ultra-efficient banks and the most inefficient banks in Russian banking system are risky. Their withdrawal from the market will contribute to the efficiency growth of the remaining banks. The latter will have a positive impact on the stability of the banking sector through the market power channel.
- Thus, Bank of Russia should not focus on increasing competition in current macroeconomic conditions, but rather on identification risky banks and propose measures aimed at solving both the efficiency problem and the asset quality problem of this group.
- The analysis revealed three possible channels of banking competition regulation be the Bank of Russia: capital adequacy ratio, loan loss provisioning and interbank market rate

Thank you for your attention!

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Additional materials

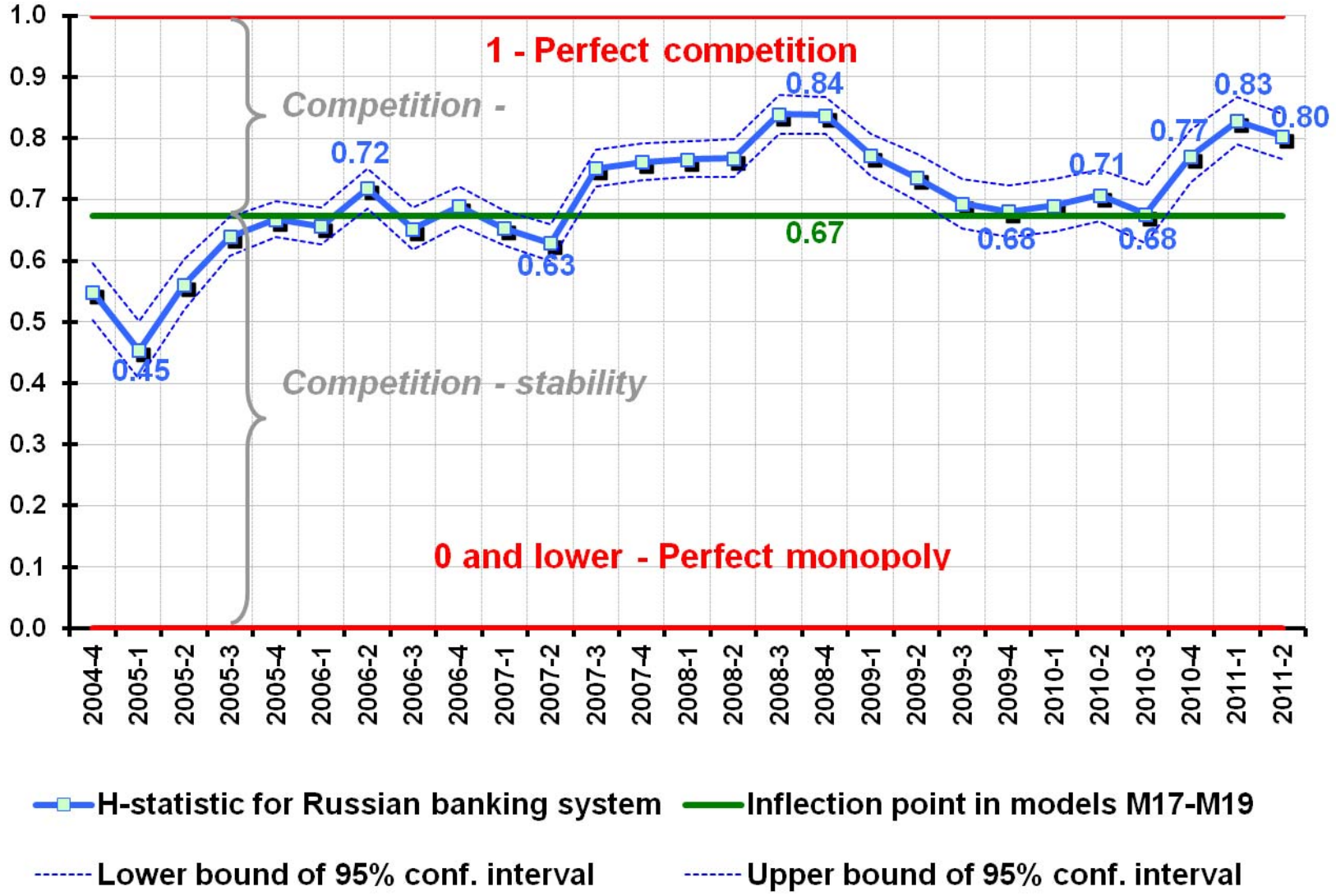
Time-series regression result: H-stat negatively affects stability (Z-stat)

independent variables	Dependent variable — Z_{stat}			
	M16	M17	M18	M19
$H_{stat}(-1)$	914.0***	786.7**	776.3***	
	(248.5)	(311.9)	(311.9)	
$H_{stat}(-2)$				881.7***
				(255.9)7
$H^2_{stat}(-1)$	–642.7***	–587.9**	–576.6***	
	(211.8)	(248.4)	(198.8)	
$H^2_{stat}(-2)$				–656.4***
				(228.7)
$HHI_{TA}(-1)$	–2704.9***		–1996.7**	–2450.4***
	(925.0)		(926.8)	(853.6)
$HHI_{EA}(-1)$		–1481.3		
		(893.8)		
$\ln \sigma_{exrate}$	–27.8***	–21.4**	–25.5***	–19.3**
	(8.9)	(9.0)	(8.3)	(7.6)
$\Delta \ln GDP_{real}(-2)$				470.6**
				(220.9)
$\Delta \ln GDP_{real}(-4)$		462.0*	451.7*	
		(243.0)	(226.0)	
$R^2_{adj.}$	0.50	0.53	0.57	0.67
Number of observations	22	22	22	22
P-value Breush-Godfrey	0.77	0.74	0.79	0.52
Inflection point for H_{stat}	0.71	0.67	0.67	0.67

** , **, *** denote an estimate significantly different from zero at the 10%, 5%, 1% level. Standard errors are in parentheses*

Competition - fragility

Time-series regression result: graphical illustration of competition threshold



Stochastic Frontier Approach

The estimated translog cost function is as following:

$$\ln OperCost = f\left(inputs(P), outputs(Y), netputs(d)\right) + u + v =$$

$$= \beta_0 + \sum_{j=1}^{2} \beta_j \ln Y_j + \frac{1}{2} \sum_{k=1}^{2} \sum_{l=1}^{2} \beta_{kl} \ln Y_k \cdot \ln Y_l + \sum_{m=1}^{2} \gamma_m \ln P_m + \frac{1}{2} \sum_{n=1}^{2} \sum_{q=1}^{2} \gamma_{nq} \ln P_n \cdot \ln P_q +$$

$$+ \sum_{r=1}^{2} \sum_{s=1}^{2} \gamma_{rs} \ln Y_r \cdot \ln P_s + \alpha_1 \cdot d_{corpor} + \alpha_2 \cdot d_{retail} + \alpha_3 \cdot d_{gover} + \alpha_4 \cdot d_{foreign} + \alpha_5 \cdot d_{moscow} +$$

$$+ u_i + v_{it}$$

$$u_i - N^{+}\left(\mu, \sigma_\mu^2\right) - inefficincy$$

$$v_{it} - N\left(0, \sigma_\mu^2\right) - error$$

Herfindahl-Hirschman index on bank level

the example of Sberbank, 2011q2