The Impact of Market Power at Bank Level in Risk-Taking: The Brazilian Case

Benjamin Miranda Tabak
(Banco Central do Brasil)
Guilherme Rodrigues Gomes
(Universidade de Brasília)
Maurício Medeiros Júnior
(Universidade de Brasília)

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Summary of the Presentation

Motivation

- The recent financial crisis increased the importance of studies related to banks' market power and its effect in the worldwide financial system dynamics.
- The relationship between this variable and risk-taking behaviors of banks is also of uttermost importance due to the current financial instability.
- Banking literature does not present a consensus interpretation of the influence of market power in banks' risk behavior.

Motivation

- Certain studies have discovered a positive relationship between bank competition and risk-taking (Keeley, 1990).
  - When banks can effectively collect monopoly rents, they will become relatively conservative as a result.
- Other investigations have found a negative relationship between these variables (Boyd and Nicol, 2005).
  - Banks with increased market power tend to suffer from moral hazard; as a result, these banks take riskier measures.
  - They conclude that the evidence regarding the theoretical relationship between the risk-taking and competition of banks is best described as mixed.

Objectives

- In light of these discussions, we aim to examine the Brazilian banking industry during the period of 2001-2011.
- We perform an analysis of market power at bank level through a non-parametric methodology called local regression.
- Our interest is to verify the impact of market power at bank level in risk-taking behaviors of banks.
- We also analyze the implications of banks capital increase in their risk-taking behavior.
    - The effect of this variable provides relevant information related to banks risk behaviors.

Methodology - Market power at the bank level

- Since market power is a non-observable variable, we estimate it using the Panzar and Rosse model developed by Rosse and Panzar (1977); Panzar and Rosse (1987).
- The Panzar and Rosse model estimates the H-statistic, which is a proxy for market power and is defined as:

$$H = \sum_{k=1}^{m} \frac{\partial R_i^*}{\partial w_{ki}} \times \frac{w_{ki}}{R_i^*} \tag{1}$$

where R_i is the revenue of bank i, w_{ki} is the input price for bank i (Bikker and Haaf, 2002).

Market power at the bank level

Table : Discriminatory power of H-statistics

Estimated values	Competitive environment	Especification
$H \leq 0$	Monopolistic market or Conjectural variation short-run oligopoly	Each bank operates independently as under monopoly profit maximization conditions or perfect cartel.
$0 < H < 1$	Monopolistic competition	There are product differentiation and banks produce more than in monopoly, however the price is less than would be in this scenario.
$H = 1$	Natural monopoly in perfectly contestable market or Perfect competition	Free entry equilibrium with full efficient capacity utilization.

Source Bikker and Haaf (2002); Rezitis (2010).

Market power at the bank level

- We use the following reduced-form revenue equation for i banks during t periods to estimate the market power:

$$\begin{aligned} \ln TR_{it} &= \alpha + \beta \ln w_{1,it} + \gamma \ln w_{2,it} + \delta \ln w_{3,it} + \\ & \quad \xi \ln Q/ASSETS_{it} + \eta \ln L/ASSETS_{it} + \varepsilon_{it} \end{aligned} \tag{2}$$

where TR is the total revenue, w_1, w_2 and w_3 are the input prices, $Q/ASSETS$ is equity over total assets, and $L/ASSETS$ is total loans over total assets.

  - w_1 is interest expenses over total deposits;
  - w_2 is overheads minus personnel expenses over fixed assets;
  - w_3 is personnel expenses over total assets.

Market power at the bank level

- The H-statistic is estimated as $H = \beta + \gamma + \delta$.
- We perform an equilibrium test to investigate if our sample is in long-run equilibrium.
- The following model is used to perform the equilibrium test:

$$\begin{aligned} \ln ROA_{it} &= \alpha + \beta \ln w_{1,it} + \gamma \ln w_{2,it} + \delta \ln w_{3,it} + \\ &\quad \xi \ln Q/ASSETS_{it} + \eta \ln L/ASSETS_{it} + \varepsilon_{it} \end{aligned} \tag{3}$$

where *ROA* is the net profit divided by equity and the other variables are the same used in Eq. (2).

- If H = 0, the observations represent a long-run equilibrium.

Market power at the bank level

- Since our purpose is to analyze the market power at the bank level, we employ a local regression technique (Cleveland, 1979; Cleveland and Devlin, 1988).
- The local regression is described by $y_i = \mu(x_i) + \varepsilon_i$ (Simonoff, 1996; Loader, 1999).

  where x_i are the observations of n predictor variables related to i banks, y_i is the response variable, the function $\mu(x_i)$ is unknown and ε_i is an error term.

- To compute the $\mu(x_i)$ approximation, we determine a bandwidth $h(x)$ and a smoothing window $(x - h(x), x + h(x))$.

Market power at the bank level

- We perform the approximation of $\mu(x_i)$ using only the observations within the interval determined by the bandwidth.
- We locally fit $\mu(x_i)$ using a linear polynomial.
- The bandwidth that we choose to apply in the local regression is equal to 0.6.
- The weight function estimates the coefficients accounting for the distances between the fitting point and the other observations presented inside the fitting point neighborhood.

Market power at the bank level

- We use the following weight function (Kernel smoother):

$$w_i = \frac{32}{5}\left(1-\left(\frac{d_i}{d_q}\right)^3\right)^3 \tag{4}$$

where q denotes the number of points in the local neighborhoods, and d_1, d_2,..., d_q denote the distances in increasing order of the points closest to the fitting point.

- The largest weight is assigned to the smallest d_i; therefore, in the local regression, w_i decreases as the distance from x increases.

Market power at the bank level

- We run a local regression using a least-squares criterion.
- We obtain a regression using each bank as a benchmark in which we employ a fixed-effects regression.
- The H-statistic is $H_i = \beta_i + \gamma_i + \delta_i$, where the subscript i denoted banks.
- We also employ time dummy variables in the model described by Eq. (2) to capture time effects in banks competitive behavior.

Risk-taking and market power at the bank level

- We apply the following risk-taking model including $h_{i,t-1}$ and $H_{i,t-1}$ variables as independent variables.

$$\begin{aligned} \ln RISK_{it} &= \alpha + \beta_1 \ln h_{i,t-1} + \beta_2 \ln Q/ASSETS_{i,t-1} \quad (5) \\ &+\beta_3 \ln \ln h_{i,t-1} * CAPITALIZATION \\ &+\beta_4 \ln PROF_{i,t-1} + \beta_5 \ln SIZE_{i,t-1} \\ &+\beta_6 \ln EFF_{i,t-1} + \beta_7 \ln H_{i,t-1} + u_{i,t-1} \end{aligned}$$

where r_{it} is a proxy for risk-taking. We use risk assets, non-performing loans and the Z-score as risk variables.

- We estimate the risk-taking model using a fixed-effects panel.

Risk-taking and market power at the bank level

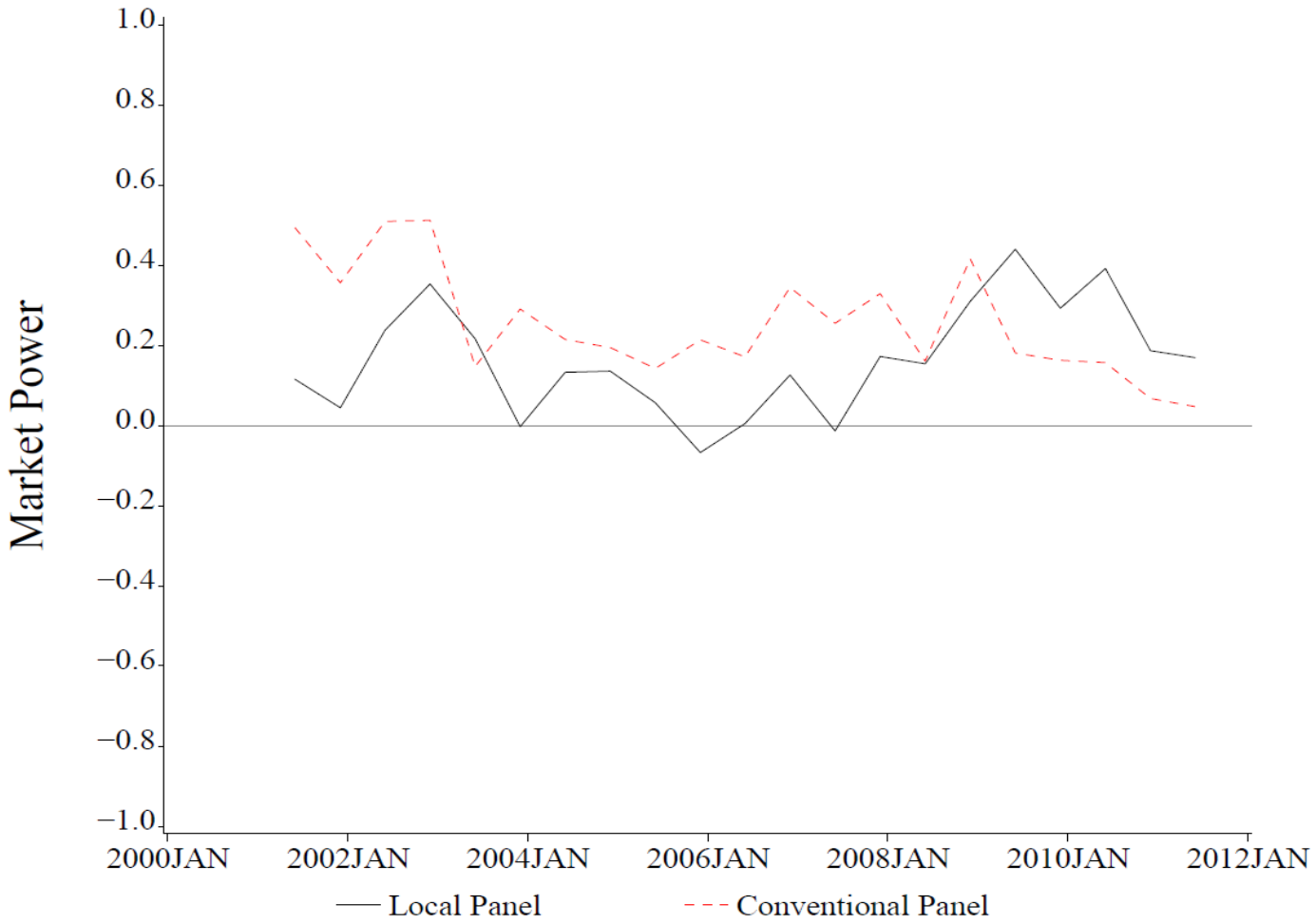
- The Z-score is computed as: $\frac{\overline{ROA}+\overline{CapitalRatio}}{\sigma_{ROA}}$
- The bank control variables applied are: capitalization ($Q/ASSET_{i,t-1}$); profitability ($PROF_{i,t-1}$); size ($SIZE_{i,t-1}$); and efficiency ($EFF_{i,t-1}$).
- We incorporate into our model both the independent variables $h_{i,t-1}$, and $H_{i,t-1}$.
  - $h_{i,t-1}$ is the lagged H-statistic at the bank level;
  - $H_{i,t-1}$ is the lagged H-statistic for the Brazil banking industry.
- We add the independent variable ln $h_{i,t-1} * CAPITALIZATION$ to our model, which the dummy variable $CAPITALIZATION$ is 1 for an increase in $Q/ASSETS_{i,t-1}$.

Data Sampling

- We use an unbalanced data of Brazilian commercial banks that spans the period from 2001 to 2011.
- Our data is built from two semiannual datasets released by the Central Bank of Brazil (TOP 50 dataset and the COSIF dataset).
    - Our sample has 76 commercial banks and 985 observations.

Results - Market power at the bank level

Figure : Difference between the H-statistics' prediction

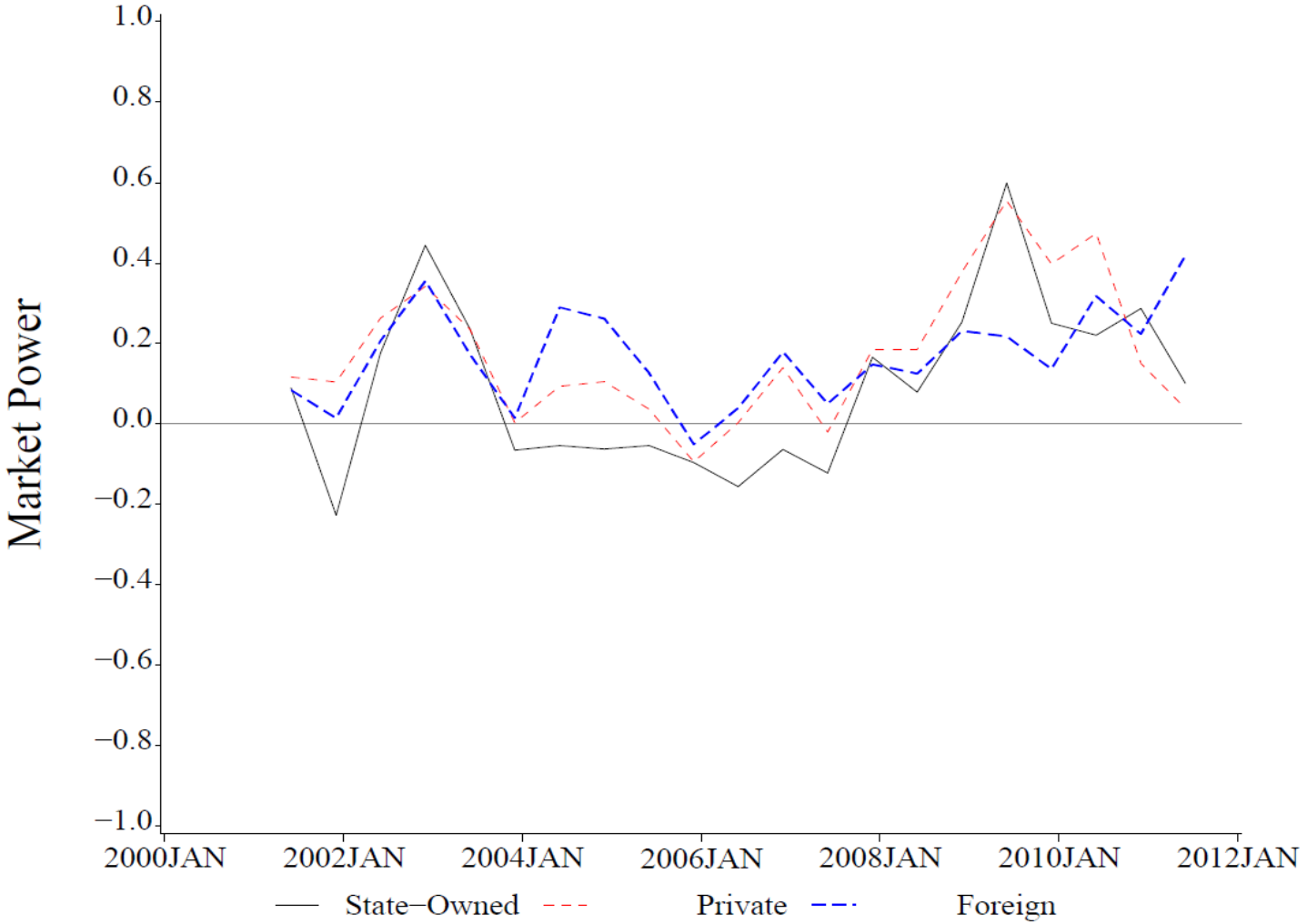


Market power at the bank level

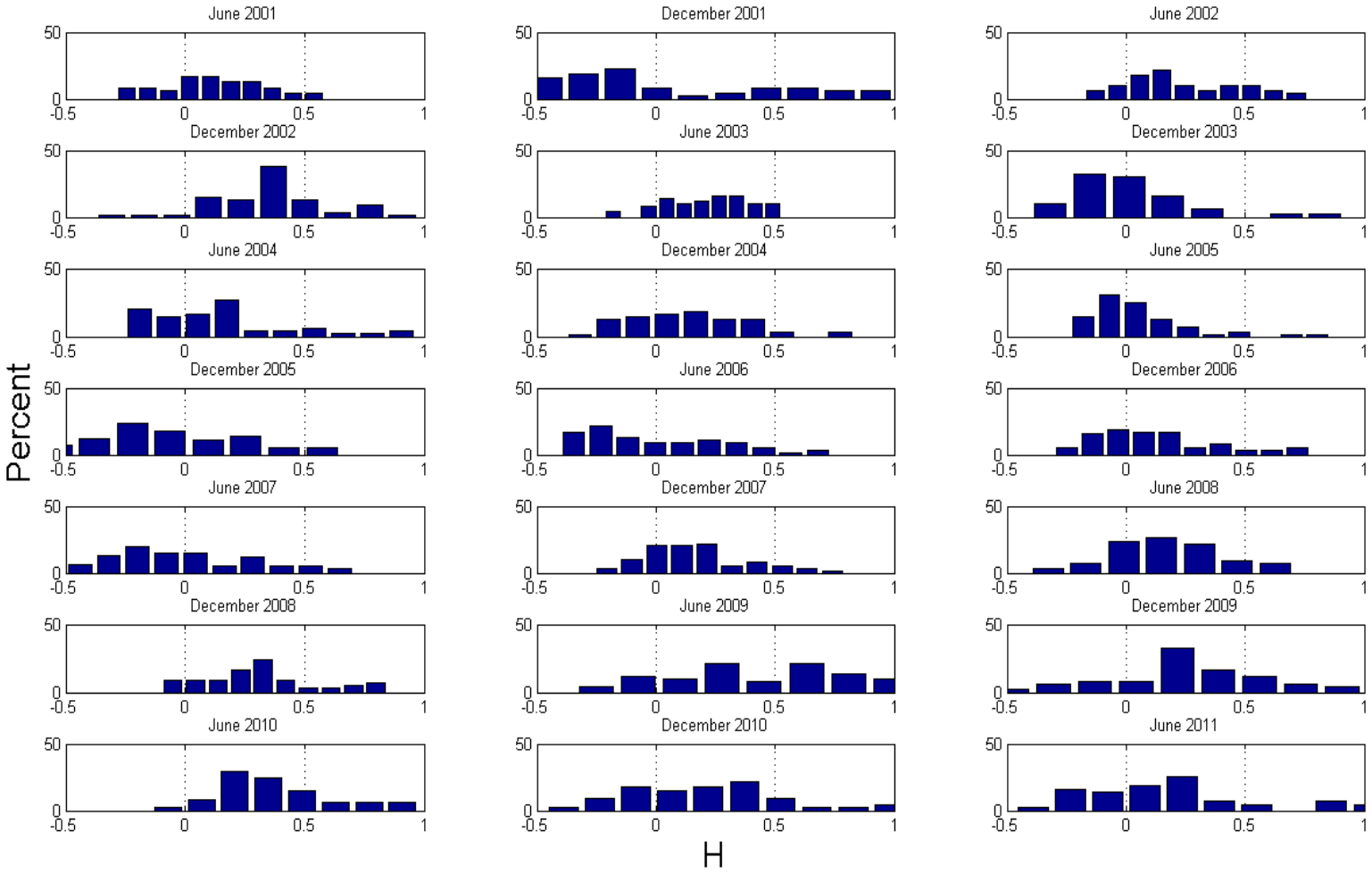
- We obtain the H-statstic through a fixed-effects panel regression and through the local regression approach (Brissimis and Delis, 2011).
- We correlate the H-statistics obtained using these two methods to assess the similarity between these two predictions.
  - The competitive behavior of the banking industry is better modeled by the local regression methodology.
    - This method computes the average H-statistic of the banking industry from the market power prediction for each bank.

Market power at the bank level

Figure : Average H-statistic over time



Market power at the bank level



Market power at the bank level

- The results show that the Brazilian banking industry includes significant heterogeneities in the market power of banks and is characterized by monopolistic competition.
- The fluctuations in the H-statistic were very intensive during the examined period.
- The Global Financial Crisis led to a significant increase in the average H-statistic.
- We observe that State-Owned banks are less competitive than Private and Foreign banks until January 2008.
  - State-Owned banks are significantly different from Private and Foreign banks.

Risk-taking and market power at the bank level

Table : Risk-taking panel description model

	Z-score
Intercept	1.50***
ln $h_{i,t-1}$	0.06*
ln $Q/ASSETS_{i,t-1}$	0.17***
ln $h_{i,t-1} * CAPITALIZATION$	-0.11**
ln $PROF_{i,t-1}$	-1.44***
ln $SIZE_{i,t-1}$	-0.00
ln $EFF_{i,t-1}$	0.17***
Time FE	YES
Cross section FE	YES
R-Square	0.61

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Risk-taking and market power at the bank level

- An increase in a bank's market power will produce an increase in the risk assumed by that bank.
  - Higher market power allows the bank to charge higher loan rates and increase their rents in the loan markets (Boyd and Nicol, 2005).
  - Moral hazard effects can cause this bank to engage in riskier but more profitable loans.
- However, Brazilian banks assume less risk if they have both an increase in market power and an increase in capital.

Conclusions

- There is significant heterogeneity in the market power of the sampled banks.
- We find that the Brazilian banking industry functions under conditions of monopolistic competition.
  - Our sample also demonstrates fluctuations in the concentration of bank market power.
- We observe increased competition in Brazilian banking industry in the Global Financial Crisis period.

Conclusions

- Banks with increasing market power engage in riskier behavior than banks with decreasing market power.
- Our findings suggest that Brazilian banks do not necessarily evince conservative behavior.
- Tabak et al. (2011b) show the presence of this effect in 10 Latin American countries including Brazil.
- These findings are of uttermost importance for the current discussion on financial regulation and financial stability.