Competition in the Banking Sector in the Czech Republic

Daniel Stavárek, Silesian University
Iveta Řepková, Silesian University

Abstract

The paper estimates the level of competition of the banking industry in the Czech Republic during the period 2000-2008. We apply Panzar-Rosse model on data from banks comprising almost 90% of the market. We found that the market was alternately in equilibrium and disequilibrium, which demonstrates a dynamic development of the Czech banking sector. While the market can be described as perfectly competitive during the period 2000-2004, the intensity of competition decreased after joining the EU in 2004 and the market can be characterized as one of monopolistic competition in 2004-2008.

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1 Introduction

Sound competition in the banking market is of great economic importance because it lowers prices and improves quality, thereby contributing to the prosperity of consumers and companies alike. Competition fosters innovative behavior, forces banks to improve their efficiency, thus promoting the access of households and firms to financial services and external finance, and thereby enhancing economic growth (Bikker, et al., 2007).

The literature on the measurement of competition can be divided into two major streams: structural and non-structural approaches. The structural approach to the measurement of competition embraces the Structure-Conduct-Performance paradigm (SCP) and the efficiency hypothesis. The two former models investigate whether a highly concentrated market causes collusive behavior among the larger banks resulting in superior market performance, and whether it is the efficiency of larger banks that enhances their performance. These structural models link competition to concentration. Non-structural models for the measurement of competition, namely the Iwata model (Iwata, 1974), the Bresnahan model (Bresnahan (1982) and Lau (1982)), and the PanzarRosse model (Panzar and Rosse, 1987), were developed in reaction to the theoretical and empirical deficiencies of the structural models. These New Empirical Industrial Organisation (NEIO) approaches test competition and the use of market power, and stress the analysis of banks' competitive conduct in the absence of structural measures (Bikker and Haaf, 2000, p. 17).

The aim of the paper is to examine the degree of competition within the Czech Republic banking industry during the period 2000-2008. The Czech Republic's financial system is traditionally bank-based and banks play an important role in the economy on the side of corporations and business as well as households. Furthermore, the banking sector in the Czech Republic went through serious crisis in late 1990s followed by a period of consolidation that included, among others, failures of small banks, privatization of large state-owned banks combined with their recapitalization and cleaning their loan portfolios. The Czech Republic joined the European Union in 2004 and the banking sector cannot stand apart from the ongoing process of financial integration within the European Union. Therefore, the analysis of competition in industry with so many important development milestones is of high interest.

2 Panzar-Rosse Model

The method developed by Panzar and Rosse (1987) determines the competitive behavior of banks on the basis of the comparative static properties of reduced-form revenue equations based on cross-section data. Panzar and Rosse show that if their method is to yield plausible results, banks need to have operated in a long-term equilibrium, while the performance of banks needs to be influenced by the actions of other market participants. The model assumes a price elasticity of demand, *e*, greater than unity, and a homogeneous cost structure. To obtain the equilibrium output and the equilibrium number of banks, profits are maximized at the bank as well as the industry level. That means, first, that bank *i* maximizes its profits where marginal revenue equals marginal cost:

$$R_i'(x_i, n, z_i) - C_i'(x_i, w_i, t_i) = 0 \quad , \tag{1}$$

where R_i is the total revenue,

C_i is the total expenses,

x_i is the output of bank *i*,

n is the number of banks,

w_i is a vector of m factor input prices of bank *i*,

z_i is a vector of exogenous variables that shift the bank‘s revenue function,

t_i is a vector of exogenous variables that shift the bank‘s cost function.

In equilibrium, the zero profit constraint holds at the market level:

$$R_i^o(x^o, n^o, z) - C_i^o(x^o, w, t) = 0 \quad . \tag{2}$$

Variables marked with ° represent equilibrium values. Market power is measured by the extent to which a change in factor input prices is reflected in the equilibrium revenues earned by bank *i*. Panzar and Rosse define a measure of competition, the *H* statistic as the sum of the elasticities of the reduced form revenues with respect to factor prices:

$$H = \sum \left(\frac{\partial R_i^o}{\partial w_{k_1}} \right) \left(\frac{w_{k_1}}{R_i^o} \right) \quad . \tag{3}$$

The estimated value of the *H* statistic ranges between $\infty < H \leq 1$. Table 1 summarizes the discriminatory power of *H*.

$H \leq 0$	Monopoly equilibrium or perfect cartel
$0 < H < 1$	Monopolistic competition
$H = 1$	Perfect competition

Tab. 1 Panzar-Rosse H statistic

An important feature of the *H* statistic is that it must be performed on observations that are in long-run equilibrium, as suggested in previous studies such as Bikker and Haaf (2002), Claessens and Laeven (2004), Casu and Girardone (2006), Matthews, et al. (2007), Fu (2009) and Rezitis (2010). This suggests that competitive capital markets will equalize riskadjusted rates of return across banks such that, in equilibrium, rates of return should be uncorrelated with input prices (Matthews, et al., 2007, p. 2030). The equilibrium test is carried out with the return on assets (or equity), replacing bank revenue as the dependent variable in the regression equation for the *H* statistic. The *E* statistic is derived from the equilibrium test and measures the sum of elasticities of rate of return with respect to input prices (Fu, 2009). If the *E* statistic is equal to zero, it indicates long-run equilibrium, while $E < 0$ reflects disequilibrium. Table 2 summarizes the discriminatory power of *E* statistic.

$E = 0$	Equilibrium
$E < 0$	Disequilibrium

Tab. 2 Equilibrium test

3 Methodology and Data

Several specifications of the Panzar-Rosse model have been used in empirical literature. One of the crucial differences among studies is the definition of the dependent variable applied in the estimation of *H* statistic. Chan, et al (2007), Pawlowska (2005), Deltuvaitė (2007) or Lee and Nagano (2008) use interest income (revenues). Alternatively, Hempell (2002), Bikker, et al. (2009) or Rezitis (2010) apply a total income or net income (de Rozas, 2007). Some authors analyze the competition in banking using a combination of more than one equation. For example, Chun and Kim (2004) or Fu (2009) have total revenues and interest revenues as dependent variables.

The dependent variable in Eq. (4) chosen for the present paper is defines total revenue to total assets, rather than only the interest part, in order to account for the fact that the importance of non-interest income has increased greatly in recent years in the Czech Republic's banking sector. This view is supported, among others, by Casu and Girardone (2006), Pererera, et al. (2006) and Rezitis (2010), who argue that in a more competitive environment, the distinction between interest and non-interest income becomes less relevant, as banks are competing on both forms. The existence of accounting differences across countries is an additional argument in favor of having a comprehensive view of bank revenues. And the dependent variable is divided by total assets in order to account for size differences as suggested by Casu and Girardone (2006).

$$\ln TREVit=\alpha 0+\alpha 1\ln PLit+\alpha 2\ln PKit+\alpha 3\ln PFit+\beta 1\ln ASSETit+\beta 2\ln BRit+\gamma 1GROWTHt+\varepsilon it, \quad (4)$$

where $TREV_{it}$ is ratio of total revenue to total assets,

PL_{it} is ratio of personnel expenses to number of employees,

PK_{it} is ratio of other expenses to fixed assets,

PF_{it} is ratio of annual interest expenses to total loanable funds (deposits + tradable securities + subordinated instruments).

Bank-specific and market-specific variables include:

$ASSET_{it}$ is sum of total assets,

BR_{it} is he ratio of the number of branches of a bank to the total number of branches of all banks,

$GROWTH_t$ is the annual real GDP growth rate,

i denotes the bank ($i = 1, \ldots, N$), t denotes time ($t = 1, \ldots, T$).

PL_{it}, PK_{it} and PF_{it} correspond to the three input prices, i.e., labor, capital and funds. Consistently with the intermediation approach, we assume that banks use all the three inputs. Other explanatory variables are chosen to account for bank-specific and market-specific factors. Similar variables are used also in Chun and Kim (2004), Matthews, et al. (2007), Fu (2009) or Rezitis (2010).

The total asset variable ($ASSET_{it}$) is included to take account of possible scale economies. The ratio of the number of branches of each bank to the total number of branches of the whole banking industry variable (BR_{it}) is used in order to account for bank size. Branching has been viewed as a means for maintaining market share by providing consumers with close-quarter access to financial services, mitigating to some extent price competition. The market-specific variable ($GROWTH_t$) is incorporated to control for the possible impact of macroeconomic factors on bank performance. It is well known that the profitability and revenue of a bank is highly sensitive to the business cycle. Bad debts and nonperforming loans vary positively with the business cycle, and accounting conventions mean that the timing of a default does not invariably coincide with the turning point of the recession, so bank performance may lead or lag the business cycle. Hence, the final equations to be estimated also include a pure time series variable, real GDP growth rate. All variables are expressed in logarithmic form.

The model assumes a one-way error component as described by

$$\varepsilon it=\mu i+\vartheta it\ , \quad (5)$$

where μi denotes the unobservable bank-specific effect and ϑit denotes a random term which is assumed to be IID. The H statistic is given by

$$H=\alpha 1+\alpha 3+\alpha 3. \quad (6)$$

For obtaining equilibrium conditions the model is defined as follows:

$$\ln ROA=\alpha 0'+\alpha 1'\ln PLit+\alpha 2'\ln PKit+\alpha 3'\ln PFit+\beta 1'\ln ASSETit+\beta 2'\ln BRit+\gamma 1'GROWTHt+uit \quad (7)$$

$$uit=\theta i+\vartheta it \quad (8)$$

where ROA is the return on assets ratio, θi is the bank-specific effect and ϑit is an IID random error. The banking market is deemed to be in equilibrium if

$$E=\alpha 1'+\alpha 2'+\alpha 3'=0 \quad (9)$$

The dataset used in the analysis covers all major Czech banks of the period 2000–2008 and has been collected from the annual bank reports and BankScope database. Over the sample period, the sample banks controlled on average about 87% of the Czech banking market with the remaining share controlled by branches of foreign banks in the Czech Republic and "special" credit institutions (building societies, State banks of special purpose, and others). The dataset consists of 15 banks over 9 years. Due to some missing observations we have an unbalanced panel of 129 bank-year observations. To allow for heterogeneity across the banks, we use an error-component model, with the bank-specific error components estimated as fixed effects.

4 Empirical Analysis and Results

The empirical analysis begins with a test for market equilibrium. Since the Czech Republic's banking sector went through dynamic development during the period of estimation it would be very ambitious to test only for equilibrium over the full sample. Instead, we run regressions of two 5-year sub-periods with 2004 as an overlap and also a rolling regression of a 4-year window in order to reveal periods of market disequilibrium. Table 3 reports the results of estimation of Eq. (7). To conserve the space only elasticities required to the equilibrium test (Eq. 9) are presented.

The results suggest that market equilibrium over the whole estimation period is questionable. On the other hand, the market was in equilibrium in most of the sub-periods. As argued in Matthews, et al. (2007) the restriction that E=0 (market equilibrium) is necessary for the perfect competition case but not for the monopolistic competition case.

	lnPL	lnPK	lnPF	Sum	H0: E=0	Eq./Diseq.
2000-2008	0.0341	-0.0025	-0.0004	0.0312	F (1, 108) = 19.14[a]	Diseq.
2000-2004	0.0585	-0.0009	0.0024	0.0600	F (1, 52) = 25.96[a]	Diseq.
2004-2008	0.0095	-0.0063	-0.0052	-0.0020	F (1, 50) = 0.0745	Eq.
2000-2003	0.0577	-0.0029	0.0072	0.0620	F (1, 37) = 23.162 [a]	Diseq.
2001-2004	0.0387	-0.0165	-0.0053	0.0169	F (1, 38) = 0.8334	Eq.
2002-2005	0.0452	-0.0192	-0.0060	0.0020	F (1, 39) = 0.9185	Eq.
2003-2006	0.0113	-0.0193	-0.0116	-0.0196	F (1, 39) = 5.0855 [b]	Diseq.
2004-2007	0.0039	-0.0047	-0.0069	-0.0077	F (1, 38) = 1.1499	Eq.
2005-2008	-0.0006	-0.0036	-0.0009	-0.0051	F (1, 35) = 0.5334	Eq.

Tab. 3 Equilibrium tests (rolling sample) dependent variable lnROA. [a, b] denote significance at 1% and 5% level

Next, we can proceed with estimation of Eq. (4) and calculation of the *H* statistic as in Eq. (6). The results presented in Table 4 show substantial differences between the sub-periods used. The common elements are only statistically significant effects of price of labor and bank size. However, the respective coefficients changes noticeably from one sub-period to the other

(*lnPL* decreased, *lnASSET* increased). Price of funds was significant over the full sample and in the first sub-period (before joining the EU) demonstrating an ability of banks to offset more expensive funds by higher revenues. Number of branches seems to be significant determinant of total revenues in the second sub-period. The positive coefficient suggests that positive effects of maintaining a proximity to customers dominate the increased cost of higher branch network. Such a result confirms a return of customers' preferences to standard face-to-face banking in brick-and-mortar branches.

Variable	**2000 – 2008**	**2000 – 2004**	**2004 – 2008**
Intercept	2.7642[a] (3.4354)	6.2587[a] (4.1462)	2.1224[c] (1.8940)
lnPL	0.7605[a] (5.8285)	0.8629[a] (4.3226)	0.4889[a] (3.3419)
lnPK	-0.0881 (-1.4079)	-0.0926 (-1.2440)	0.1399 (1.2296)
lnPF	0.2077[a] (4.3668)	0.2055[a] (3.0636)	0.0729 (1.3269)
lnASSET	0.5934[a] (9.2126)	0.2976[b] (2.2535)	0.6537[a] (7.4535)
lnBR	-0.0120 (-0.3250)	0.0603 (1.0225)	0.1803[a] (2.7076)
GROWTH	-0.7810 (-0.5244)	-0.9515 (-0.2811)	-1.1818 (-0.9179)
H0: μi=0	*F* (14, 108) = 14.282[a]	*F* (14, 52) = 9.5400[a]	*F* (14, 50) = 14.341[a]
H0: H=0	*F* (1, 108) = 30.365[a]	*F* (1, 52) = 15.234[a]	*F* (1, 50) = 15.296[a]
H1: H=1	*F* (1, 108) = 3.9343[c]	*F* (1, 52) = 0.0093	*F* (1, 50) = 4.0841[b]
H	0.8801	0.9758	0.7017

Tab. 4 Test of competitive conditions dependent variable lnTREV. [a, b, c] denote significance at 1%, 5% and 10% level, t-values in parentheses

A significance test on the sum of the input elasticities show that the *H* statistic lies between zero and unity in the full sample and second sub-period. By contrast, the *H* statistic in the first sub-period is not significantly different from unity. Thus, we can conclude that the Czech banking market can be characterized as one of monopolistic competition in 2000-2008 and 2004-2008 but as the market with perfect competition in 2000-2004. In other words, there is evidence that intensity of competition decreased over the estimation period.

5 Conclusion

The aim of the paper was to estimate the level of competition in the Czech banking market during the period 2000-2008. Applying the Panzar-Rosse model we came to conclusion that the competitive conditions worsened over time analyzed. Whereas the banking market during the first sub-period 2000-2004 (before joining the EU) was found to be perfectly competitive the structure of monopolistic competition was revealed during the second sub-period 2004-2008 (after joining the EU). More concetely, the *H* statistic computed for the full sample is 0.8801, the *H* statistic for the first sub-period is 0.9758, and the *H* statistic for the second sub-period 0.7017.

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