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Competition in Chinese Commercial Banking

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This study assesses competitive conditions in the Chinese commercial banking industry during a period of major structural change. In particular, the Rosse-Panzar *H*-statistic is estimated for a panel of 76 banks over the period 1997-2006. The results show that banks in China operate under a system of monopolistic competition in general. The disaggregated analyses suggest that the intensity of competition in the core market for bank lending increased after China's World Trade Organisation accession and alongside interest rate liberalisation. However, it seems that competition has become less intense in the non-core market for Chinese banks.

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1. Introduction

The last 30 years have seen dramatic structural change in China's commercial banking industry. Before 1978, China had a monopolistic banking system modelled after that of the Soviet Union. In order to improve economic efficiency and resource allocation, a "two-tier" banking system was created in 1979, with the institution of four state-owned specialised banks and several medium- and small-sized commercial banks. In 1993, the Chinese government launched a new round of banking reform aiming at creating a competitive banking system. The four specialised state banks were converted into wholly state-owned commercial banks in 1994. More commercial banks were then introduced into the market in the mid-1990s. Meanwhile, a blueprint for carrying out market-based interest rate reform was drawn up by the central bank. In order to enhance competitiveness in the banking sector, new policies of financial liberalisation and restructuring have been implemented since 1998. These include gradual interest rate liberalisation, the World Trade Organisation (WTO) commitment to fully open the banking market, the joint-stock reform of the big state-owned banks, the creation of rural commercial banks, and the expansion and listing of domestic commercial banks.

Against such a background of significant structural change, the purpose of this study is to examine the intensity of competition in China's commercial banking sector. In particular, this study estimates reduced form bank revenue equations for a sample of Chinese commercial banks over the period 1997-2006 and uses the Rosse-Panzar model to assess competitive conditions in Chinese commercial banking. The rest of this study is organised as follows. Section 2 outlines developments in Chinese commercial banking during the sample period. Section 3 gives a brief review of some previous studies that have evaluated non-structural measures of competition in banking sectors. Section 4 describes the econometric models and data. Section 5 analyses the results, and section 6 concludes.

2. Overview of China's commercial banking sector

China's commercial banking sector has experienced remarkable changes during the past three decades.[2] Until 1978, China operated a monopolistic banking system based on socialist principles. In

[1] I am very grateful for funds provided by University of Macau. I thank two anonymous referees for helpful comments. All errors are my responsibility.
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[2] For detailed descriptions, see Fu and Heffernan (2009) and Berger et al. (2009), among others.

order to increase economic efficiency and improve resource allocation, China initiated the first stage of banking reform in 1979, which created a "two-tier" banking system consisting of the PBC (the central bank), four state-owned specialised banks, and several medium- and small-sized commercial banks. In 1993, the State Council announced the second stage of bank reforms. One objective was to create a competitive commercial banking sector where state banks co-existed with other forms of banking institutions. Multiple new bank types were created, including national joint-stocks, city commercial banks, and foreign banks. Meanwhile, the central bank had taken important steps to liberalise interest rates in accordance with the government policy of gradually introducing a market-determined interest rate system based on the central bank rate. By 1997, a nationwide unified inter-bank market had been created, and both the inter-bank lending rate and the inter-bank bond market rate had been liberalised.

In order to enhance competition in the banking system, new policies of financial liberalisation and restructuring have been implemented since 1998. Given that deposits and loans have constituted the core business of commercial banks in China, the introduction of market-based deposit and lending rates is key to the success of the overall banking reform process. The guiding principles are to liberalise the foreign currency interest rate before the domestic currency rate, the lending rate before the deposit rate, and the large and long-term funds before the small and short-term funds. Gradual interest rate deregulation has provided incentives for banks to strengthen assets and liability management, boost capital adequacy, better cover risk premiums, and make room to earn higher profits.[3]

Although China's banking sector was opened to foreign banks in the late 1970s, foreign participation was limited until 11 December 2001, when China joined the WTO after 16 years of negotiations. WTO commitments required that China phase out restrictions on foreign banks. All the non-prudential restrictions on ownership and operational and organisational setup, including restrictions on the number of branches and licenses, needed to be removed by 2006. Foreign banks could enjoy "equal treatment" in China, meaning that they would be treated no differently from the domestic banks.[4] Since December 2003, the China Banking Regulatory Commission has allowed foreign banks to own up to 25% of any domestic financial institution.[5] At the end of 2008, foreign investors had equity investments in 31 domestic banks, totalling US$78.29 billion.

In addition to interest rate deregulation and WTO accession, the structural reforms of the domestic banks were also substantial. The joint-stock reform of the four large state-owned banks (the Big Four) was of key importance to the overall economy and included the following steps: the issuance of a special Treasury bond of US$32.61 billion in 1998, the establishment of four asset management corporations in 1999, capital injections of US$45 billion and US$15 billion in 2003 and 2005, respectively, and the IPOs of three big state-owned banks between 2005 and 2006.[6] As a result of deregulation, other types of domestic banks (i.e., national joint-stocks and city commercial banks) also experienced tremendous growth, establishing more branches in various locations, developing more innovative products, accepting foreign strategic investments, and going public in order to enhance their capital bases. Only two national joint-stocks listed some of their shares in the 1990s, whereas nine other national joint-stocks and city commercial banks were listed in the 2000s. Thus, there were 14 listed banks in China in total by 2008. Finally, several rural commercial banks have been created since 2001 in order to improve financial services in the countryside. Overall, in 2008, China's commercial banking sector consisted of five state-owned commercial banks, 12 joint-stock commercial banks, 136 city commercial banks, 22 rural commercial banks, and 28 locally incorporated foreign banks. All these banks are supervised by the China Banking Regulatory Commission (China Banking Regulatory Commission, 2009).

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[3] For details of the gradual reform procedures, please see People's Bank of China (2005, 2006, 2007).

[4] Source: People's Bank of China, 2002.

[5] There is a cap of 20% for any single foreign investor. Source: China Banking Regulatory Commission (2003).

[6] For details, please see Fu (2004).

Table 1 illustrates the structural characteristics of China's commercial banking sector from 1997 to 2006. Two common measures of concentration, the four-bank concentration ratio (*CR4*) and the Herfindahl-Hirschman Index (*HHI*), are calculated.[7] *CR4* is defined as the ratio of the total loans of the four largest banks to the total loans of all the banks in a given year. Higher *CR4* reflects a more concentrated market.[8] *HHI* is defined as the sum of the squared market shares of the loans of the sample of banks in a given year. The index can range from zero in a market with an infinite number of banks to one in a market with only one bank.[9] In general, both the *CR4* and the *HHI* measures show a trend of modest decrease, meaning that market concentration changed appreciably over the sample period. Furthermore, according to the current screening guidelines in the US, China's banking market could have been described as a "very concentrated market" before it joined the WTO in 2001. It then became a "moderately concentrated market" over the period of 2002-2006.[10]

Table 1
Market concentration in China's commercial banking sector

Measure/Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
CR4	0.618	0.624	0.602	0.585	0.567	0.557	0.547	0.539	0.542	0.535
HHI	0.230	0.226	0.216	0.204	0.193	0.179	0.165	0.161	0.141	0.134

Notes: *CR4*: four-bank concentration ratio; *HHI*: Herfindahl-Hirschman Index.

In summary, during 1997-2008, competition among banks seems to have increased through the gradual introduction of more banks to the market. In addition, China's WTO accession means that there should have been greater involvement on the part of foreign banks than ever before, which would lead to intensified competition in the sector. Banks have been given more autonomy and greater chances to improve their competitiveness through bank listings, foreign equity investments, and interest rate liberalisation. Finally, the market concentration measures show that China's banking sector changed from a heavily concentrated market to a somewhat concentrated market in 2001-2002, right after China joined the WTO.

3. Literature review

In the banking literature, the '*H*-statistic' developed by Rosse and Panzar (1977) and Panzar and Rosse (1982, 1987) is the most popular non-structural model examining the competitive structure of the banking industry in various countries.[11] The *H*-statistic is computed from reduced form revenue equations and measures the sum of elasticities of a bank's revenue with respect to the bank's input prices. It identifies the nature of the market structure in which the bank operates. In particular, the *H*-statistic is non-positive if the market structure is a monopoly, a perfectly colluding oligopoly, or a conjectural-variation, short-run oligopoly. In such a case, an increase in input prices will increase marginal cost and reduce equilibrium output as well as revenue accordingly. The *H*-statistic is unity if the market structure is characterised as perfect competition. Under this condition, any increase in input prices will increase both marginal and average costs without changing the equilibrium output of any individual bank. This is true because those banks that cannot cover their increase in input

[7] Following the common practices (e.g., Fu and Heffernan, 2009; Berger et al. 2009, among others), this study also considers China's banking market as a national market.

[8] The major shortcoming of the *CR4* measure is that it gives equal emphasis to the top four banks but neglects the many small banks in the market.

[9] *HHI* takes into account both the number of banks and the inequality of market shares. However, it is not without its critics. As indicated by Hannah and Kay (1977), it uses a particular weighting of the inequality of the firms' market shares and the number of firms.

[10] As specified by Federal Reserve Bank, the banking market is regarded to be competitive if the *HHI* is less than 0.1, moderately concentrated if the *HHI* ranges between 0.1 and 0.18, and very concentrated if the *HHI* is higher than 0.18 (Federal Reserve Bank, 1998).

[11] The non-structural models emphasise the analysis of the competitive conduct of banks without using explicit information about the market structure, whereas the structural models are based on the structure of the banking market (Al-Muharrami et al., 2006).

prices will be forced to exit the market. The *H*-statistic is also equal to one for a natural monopoly operating in a perfectly contestable market and a sales-maximising bank subject to break-even constraints. Finally, if the market structure is characterised by monopolistic competition, the *H*-statistics may lie between zero and one, as revenues will increase less than proportionally to changes in input prices.

An important feature of the *H*-statistic is that the tests must be undertaken on banks that are in long-run equilibrium. This is justified on the grounds that competitive capital markets will equalise risk-adjusted rates of return across banks. Thus, rates of return should not be correlated statistically with input prices in equilibrium. 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*-statistics. The *E*-statistic is derived from the equilibrium test and measures the sum of elasticities of rate of return with respect to input prices. If the *E*-statistic is equal to zero, it indicates long-run equilibrium. If the *E*-statistic is negative, it reflects disequilibrium. Table 2 summarises the theoretical interpretations of the *H*-statistics for measuring competitive conditions in the banking market, as well as the *E*-statistics for testing equilibrium conditions.[12]

Table 2
Theoretical Interpretation of the *H*- and *E*- statistics

Equilibrium test	
$E = 0$	Equilibrium
$E < 0$	Disequilibrium
Competitive environment test	
$H \leq 0$	Monopoly or conjectural-variation, short-run oligopoly
$0 < H < 1$	Monopolistic competition
$H = 1$	Perfect competition or natural monopoly in a perfectly contestable market or sales-maximising firm subject to a break-even constraint

Source: Molyneux et al. (1994).

The Rosse-Panzar model has been applied widely in the banking literature. Table 3 summarises the results of these investigations. Most found that banks operated under conditions of monopolistic competition. However, there has been only one study that has used the Rosse-Panzar approach for examining the competitiveness of China's banking industry.[13] Yuan (2006) estimated reduced form bank revenue equations for a sample of 15 major Chinese commercial banks over the period 1996-2000. The findings suggest that the Chinese banking system as a whole was in a state of near-perfect competition over the entire sample period. The year-by-year analysis indicates that 1996, 1997, 1999, and 2000 featured perfect competition, while 1998 was characterised by a state of

[12] For details, please see Shaffer (1982, 1983), Molyneux et al. (1994), and Matthews et al. (2007).

[13] There are some other studies related to bank competition in China that estimate bank efficiency and competition using structural models. Among others, Fu and Heffernan (2009) investigated the relationship between market structure and performance in China's banking sector over the period 1985-2002 and found that X-efficiency declined significantly on average, and that most banks were operating below scale-efficient levels. Furthermore, banks with a large market share and well-differentiated products could exercise market power in pricing and earn supernormal profits in the early period. The reform had little impact on the bank structure in China. Fu and Heffernan argued that new policies should be directed at encouraging market entry and increasing the market share of the most efficient banks. Yao et al. (2007) estimated the effects of ownership structure and the implementation of a "hard" budget constraint on bank efficiency. The results show that non-state banks were more efficient than state banks, and that banks facing hard budget constraints tended to perform better than those relying on substantial government capital injections.

monopolistic competition. The study concludes that China's banking industry "already had the characteristics of competitiveness before its accession to the WTO" and that "it seems that opening the Chinese banking market to foreign firms will not promote further competition in China, though it might have effects on firms' financing" (p. 533). Finally, the study indicates that the estimation would be more accurate if long-time series data were available, and that it would also be meaningful to test competitive conditions after WTO accession. The present study fills the void by employing a much larger sample of 76 banks to examine the intensity of competition in China's banking industry over a longer period of time that covers both the pre-WTO era and the five years following WTO accession. Using such a rich sample set, this study particularly investigates whether the Chinese banking market could improve its competitiveness by 2006, the last year when China had to fully open up its banking market to foreign participants.

4. Methodology and data

Following the common practice, the models for obtaining measures of the competitive banking environment (i.e., *H*-statistic) in China are of the following logarithmic form:

$$\ln REV_{it} = \alpha_0 + \alpha_1 \ln PF_{it} + \alpha_2 \ln POI_{it} + \alpha_3 \ln RISKASS_{it} + \alpha_4 \ln ASSET_{it} + \alpha_5 \ln GROWTH_i + \varepsilon_{it} \quad (1)$$

$$\ln INTREV_{it} = \alpha_0 + \alpha_1 \ln PF_{it} + \alpha_2 \ln POI_{it} + \alpha_3 \ln RISKASS_{it} + \alpha_4 \ln ASSET_{it} + \alpha_5 \ln GROWTH_i + \varepsilon_{it} \quad (2)$$

where

ln = natural logarithm
REV = ratio of bank total revenue to total assets
INTREV = ratio of bank interest revenue to total assets
PF = ratio of annual interest expenses to total borrowing funds (unit price of funds)
POI = ratio of annual non-interest expenses to total fixed assets (unit price of other inputs)[14]
RISKASS = ratio of provisions to total assets
ASSET = total assets
GROWTH = real GDP growth rate

The *i*-subscript denotes banks (i = 1, …, N), and the *t*-subscript denotes time (t = 1, …, T). Equation (1) is estimated to obtain measures of market competitiveness with respect to the overall banking activities, whereas Equation (2) focuses on core banking business, such as lending. The *H*-statistic is given by $H = \alpha_1 + \alpha_2$, which implies that the focus is on how bank total revenues (*REV*) or interest revenues *(INTREV)* react to variations in the input prices, *PF* and *POI*. Other independent variables are chosen to account for bank-specific and market-specific factors. Specifically, *RISKASS* measures the riskiness of the bank's overall portfolio.[15] *ASSET* is included to take account of possible scale economies. Finally, as suggested by Matthews et al. (2007), *GROWTH* is incorporated to control for the possible impact of macroeconomic factors (e.g., the economic cycle) on bank performance.

Similarly, the equilibrium condition is modelled as:

$$\ln ROA_{it} = \beta_0 + \beta_1 \ln PF_{it} + \beta_2 \ln POI_{it} + \beta_3 \ln RISKASS_{it} + \beta_4 \ln ASSET_{it} + \beta_5 \ln GROWTH_i + \upsilon_{it} \quad (3)$$

where *ROA* is the return on assets and the independent variables are as defined above. The market is in long-run equilibrium if $E = \beta_1 + \beta_2 = 0$, i.e., bank rates of return should not be significantly correlated with input prices.

Estimations are carried out for an unbalanced panel of 76 major commercial banks in China over the period 1997-2006. The total number of observations is 407. Specifically, the sample is comprised of four state-owned banks, 13 national joint-stocks, 46 city commercials, six rural

[14] It is impossible to calculate the unit prices of labor and capital separately because the data on personnel expenses and capital expenses are unavailable.

[15] The effect of the risk measure on bank revenue could be either positive or negative. It might be positive because a higher level of provisions indicates a more risky loan portfolio and hence a higher level of return. In contrast, a negative effect is expected if an increase in provisions is a diversion of capital from earnings.

commercials and seven foreign banks. These accounted for more than 90% of the total assets of China's commercial banking sector in 2006.[16] In addition, the sample period is divided into two stages, pre-WTO (1997-2001) and post-WTO (2002-2006). Estimates are made separately for the sub-samples in order to examine whether there is any difference between bank pre- and post-WTO competitive conditions.

Table 3
Summary of the Rosse-Panzar model results from previous studies

Authors	Period	Countries	Results
Shaffer (1982)	1979	New York (US)	Monopolistic competition
Nathan and Neave (1989)	1982-84	Canada	1982: perfect competition; 1983-84: monopolistic competition
Lloyd-Williams et al. (1991)	1986-88	Japan	Monopoly
Molyneux et al. (1994)	1986-89	France, Germany, Italy, Spain, UK	Monopoly: Italy Monopolistic competition: France, Germany, Spain, UK
Vesala (1995)	1985-92	Finland	Monopolistic competition
Molyneux et al. (1996)	1986-88	Japan	Monopoly: 1986 Monopolistic competition: 1988
Coccorese (1998)	1988-96	Italy	Monopolistic competition
Hondroyiannis et al. (1999)	1993-95	Greece	Monopolistic competition
De Bandt and Davis (2000)	1992-96	France, Germany, Italy	Large banks: monopolistic competition in all countries; Small banks: monopolistic competition in Italy, monopoly in France and Germany
Bikker and Haaf (2002)	1988-98	23 OECD countries	Monopolistic competition
Hempell (2002)	1993-98	Germany	Monopolistic competition
Murjan and Ruza (2002)	1993-97	Arab Middle East	Monopolistic competition
Belaisch (2003)	1997-00	Brazil	Monopolistic competition
Claessens and Laeven (2004)	1994-01	6 developed countries	Monopolistic competition
Coccorese (2004)	1997-99	Italy	Monopolistic competition
Gelos and Roldos (2004)	1994-00	8 European and Latin American countries	Monopolistic competition except for Argentina and Hungary (perfect competition)
Prasad and Ghosh (2005)	1996-04	India	Monopolistic competition
Al-Muharrami et al. (2006)	1993-02	Arab GCC countries	Perfect competition: Kuwait, Saudi Arabia and the UAE Monopolistic competition: Bahrain, Qatar and Oman
Casu and Girardone (2006)	1997-03	15 EU member countries	Monopolistic competition
Staikouras et al. (2006)	1998-02	25 EU member countries	Monopolistic competition
Yuan (2006)	1996-2000	China	Perfect competition
Matthews et al. (2007)	1980-04	UK	Monopolistic competition
Yildrim and Philippatos (2007)	1993-00	14 CEE countries	Monopolistic competition

[16] The remaining banks are excluded due to unavailability of data.

Data are mainly collected from various issues of the *Almanac of China's Banking and Finance*, the *Financial News*,[17] and annual reports and official websites of individual banks.[18] Table 4 presents summary data for the variables employed in this study. All financial data are deflated by CPI with 1997 as the base year.[19] Given the presence of the panel dataset, this study first employs the fixed effects panel data approach[20] to estimate the equilibrium and competitive equations specified above for the full sample (1997-2006) and the two sub-samples (1997-2001 and 2002-2006). Then, the year-by-year estimations are generated using the OLS method.

Table 4
Descriptive Statistics

Variable	*REV*	*INTREV*	*ROA*	*PF*	*POI*	*RISKASS*	*ASSETS*	*GROWTH*	*No. of obs.*
1997-2006									
Mean	0.045	0.042	0.006	0.025	1.084	0.035	422,029.500	0.096	407
S.D.	0.020	0.020	0.006	0.021	1.766	0.109	1,095,008.000	0.011	
Min	0.001	0.007	-0.009	-0.007	0.008	0.000	2.516	0.076	
Max	0.271	0.270	0.090	0.280	27.50	0.843	6,847,755.000	0.111	
1997-2001 (pre-WTO stage)									
Mean	0.055	0.051	0.006	0.036	0.886	0.041	487,045.900	0.082	130
S.D.	0.027	0.026	0.007	0.028	0.976	0.134	1,016,015.000	0.005	
Min	0.019	0.022	-0.009	0.009	0.009	0.000	2.516	0.076	
Max	0.271	0.270	0.024	0.280	8.667	0.778	4,691,607.000	0.093	
2001-2006 (post-WTO stage)									
Mean	0.041	0.038	0.005	0.020	1.176	0.032	391,516.400	0.102	277
S.D.	0.014	0.014	0.006	0.014	2.028	0.096	1,130,664.000	0.006	
Min	0.001	0.007	-0.005	-0.007	0.008	0.000	5.519	0.091	
Max	0.129	0.126	0.090	0.137	27.50	0.843	6,847,755.000	0.111	

Notes: *REV* = ratio of bank total revenue to total assets; *INTREV* = ratio of bank interest revenue to total assets; *ROA* = return on total assets; *PF* = ratio of annual interest expenses to total borrowing funds (unit price of funds); *POI* = ratio of annual non-interest expenses to total fixed assets (unit price of other inputs); *RISKASS* = ratio of provisions to total assets; *ASSET* = total assets; *GROWTH* = real GDP growth rate.

5. Empirical Results

Table 5 presents the results of the equilibrium tests with *lnROA* as the dependent variable. The *E*-statistic is different from zero for all three panel estimations. Furthermore, given the dynamic changes within the Chinese commercial banking sector during the sample period, it is not surprising to find from the year-by-year estimations that market equilibrium may not have held over the full sample period. Specifically, the market was not in equilibrium in either 1998 or 2005. However, as argued by Shaffer (2004), the equilibrium restriction is necessary only for the case of perfect competition and not for that of monopolistic competition. Therefore, such a finding would be incorrect only if it were disclaimed that the Chinese commercial banking market was perfectly competitive. The sign for *lnRISKASS* is significantly positive in the majority of the regressions, supporting the argument that higher risk requires a higher-compensating return. The significantly negative effect of *lnASSET* on *lnROA* in most cases indicates that the banking market in China as a whole faces diseconomies of scale. The sign for *lnGROWTH* is mainly significantly positive,

[17] The Financial News is a daily financial newspaper in China. It was founded in 1987 by the Chinese central bank, together with seven large financial institutions (including the Big Four).

[18] The author is grateful to Ms. Angel Kuang for her assistance with data collection.

[19] The conventional computation of correlation coefficients ranged between 0.017 and 0.265. Therefore, there is no strong evidence of multicollinearity.

[20] The advantages of using the fixed effects panel data approach include the fact that (1) unobserved heterogeneity can be controlled for by including bank fixed effects, i.e., all bank-specific, non-time-varying determinants of profits/revenues not explicitly addressed in the regression specification are captured by the fixed effects; (2) using the panel data approach could generate more reliable estimates through observations of the behavior of banks over time.

suggesting that bank profitability is highly sensitive to the economic cycle, and lending support to the pro-cyclical mark-up theory.[21] Regarding competitive condition tests, based on the market concentration measures (*CR4* and *HHI*) shown in Table 1, it is expected that the *H*-statistic for testing the competitive positions in China's commercial banking market will be greater than zero and less than unity. This implies that banks in China operated under conditions of monopolistic competition during the sample period. Tables 6 and 7 present the estimation results of equations (1) and (2) using *lnREV* and the *lnINTREV*, respectively, as the dependent variables. The *H*-statistics can be meaningfully interpreted in this study because the findings from the equilibrium tests illustrate that for the majority of the regressions, the data are in long-run equilibrium. There are three common elements to the two tables. First, the estimated *H*-statistic lies between zero and one for all regressions, and it is significantly different from both zero and one for the majority of the regressions. This result is consistent with the concentration measures mentioned above, as well as with the results of most of the previous studies shown in Table 3. Thus, commercial banks in China operated under conditions of monopolistic competition during the sample period in general.

Table 5
Tests of equilibrium-dependent variable *lnROA*

Period	*intercept*	*lnPF*	*lnPOI*	*lnRISKASS*	*lnASSET*	*lnGROWTH*	R^2	*E*	*Eq/Dis*
1997-2006									
Coef.	0.025***	0.004	0.005**	0.060***	-0.0040***	0.224***	0.177	0.009	Eq.
1997-2001 (before WTO entry)									
Coef.	0.048***	-0.007	0.004	0.010	-0.0050***	0.140*	0.254	-0.003	Eq.
2002-2006 (after WTO entry)									
Coef.	-0.013	0.007	0.001	0.192***	0.0005	0.132	0.376	0.007	Eq.
1997									
Coef.	0.021***	-0.002	0.004	0.006	-0.0010**		0.141	0.002	Eq.
1998									
Coef.	0.010*	0.176*	-0.001	-0.005	-0.0010*		0.250	0.175[a]	Dis.
1999									
Coef.	0.004	0.038	0.007**	0.020**	-0.0004		0.005	0.045	Eq.
2000									
Coef.	0.004	-0.035	-0.001	0.023**	0.0001		0.104	-0.036	Eq.
2001									
Coef.	0.009***	-0.026	-0.002	0.030**	-0.0004**		0.563	-0.028	Eq.
2002									
Coef.	0.005**	0.035	0.001	-0.002	-0.0002*		0.099	0.036	Eq.
2003									
Coef.	0.007***	-0.062	-0.001	-0.002	-0.0001		0.065	-0.063	Eq.
2004									
Coef.	0.005*	-0.004	0.001	0.014**	-0.0001		0.019	-0.004	Eq.
2005									
Coef.	0.010**	-0.077*	0.002	0.092***	-0.0010*		0.635	-0.075	Dis.
2006									
Coef.	0.009***	0.011	0.002*	0.021***	-0.001**		0.295	0.013	Eq.

Notes: *lnROA* is the dependent variable in the equilibrium test. *ROA* = return on total assets; *PF* = ratio of annual interest expenses to total borrowing funds (unit price of funds); *POI* = ratio of annual non-interest expenses to total fixed assets (unit price of other inputs); *RISKASS* = ratio of provisions to total assets; *ASSET* = total assets; *GROWTH* = real GDP growth rate. *ln*: natural logarithm; *E*: *E*-statistic; *Eq/Dis*: long-term equilibrium or disequilibrium. *lnGROWTH* is dropped in the year-by-year estimation. The *t*-statistics are in parentheses. ***, **, and * indicate a significant difference from zero at 1%, 5%, and 10%, respectively. *a* means that the *E* value is different from zero at a 5% level of significance using the Wald *F* test, i.e., the null hypothesis $E = 0$ is rejected at a 5% level of significance.

[21] Theoretical models suggest both pro-cyclical and counter-cyclical mark-ups (Rotemberg and Saloner, 1986; Green and Porter, 1984). Empirical support for the two theories has been found by De Guevara et al. (2005) and Mandelman (2006), respectively.

Second, the year-by-year estimations of both models indicate that the competitive condition in 1998 was "undetermined". In this year, a perfect competitive market is suggested by the *H*-statistic, which is significantly greater than zero but not significantly different from one. However, the *E*-statistic for 1998 is significantly different from zero, showing that the market was not in long-run equilibrium. Given that long-run equilibrium is the critical assumption of the perfect competition theory, the competitive condition in 1998 is labelled "undetermined". The final common element is the strongly explanatory power of the price of funds (*lnPF*), bank size (*lnASSET*), and real GDP growth rate (*lnGROWTH*). The result confirms the diseconomies of scale and the pro-cyclical mark-up in Chinese banking. In addition, there is a significantly positive relationship between fund price and bank revenues. This finding is consistent with those of many previous studies (e.g., Molyneux et al., 1994; Al-Muharrami et al., 2006; Matthews et al., 2007) and could be explained by the co-movement of borrowing and lending rates in the banking market.

Table 6
Tests of competitive conditions-dependent variable *lnREV*

Period	*intercept*	*lnPF*	*lnPOI*	*lnRISKASS*	*lnASSET*	*lnGROWTH*	R^2	*H*	*C*
1997-2006									
Coef.	0.057***	0.886***	0.007***	0.005	-0.008***	0.405***	0.927	0.893[a,b]	MC
1997-2001 (before WTO entry)									
Coef.	0.098***	0.872***	0.008**	0.003	-0.011***	0.334***	0.962	0.880[a,b]	MC
2002-2006 (after WTO entry)									
Coef.	0.017*	0.751***	0.007***	0.011	-0.004***	0.437***	0.780	0.758[a,b]	MC
1997									
Coef.	0.042***	0.869***	0.006	-0.177***	-0.001		0.941	0.875[a,b]	MC
1998									
Coef.	0.029***	0.876***	0.007	-0.074***	-0.0004		0.839	0.883[a]	UN
1999									
Coef.	0.035***	0.657***	-0.002	-0.042***	-0.0005*		0.851	0.655[a,b]	MC
2000									
Coef.	0.027***	0.785***	0.002	-0.049***	-0.0004		0.830	0.787[a,b]	MC
2001									
Coef.	0.020***	0.878***	0.0005	-0.054***	0.00004		0.852	0.879[a]	PC
2002									
Coef.	0.031***	0.761***	-0.004	-0.054***	-0.001**		0.740	0.757[a,b]	MC
2003									
Coef.	0.029***	0.725***	-0.001	-0.062***	-0.0003		0.722	0.725[a,b]	MC
2004									
Coef.	0.019***	0.789***	0.005**	-0.068***	0.0004		0.825	0.794[a,b]	MC
2005									
Coef.	0.032***	0.640***	0.003	-0.073***	-0.0003		0.751	0.642[a,b]	MC
2006									
Coef.	0.028***	0.805***	0.003	-0.076***	-0.0002		0.728	0.808[a,b]	MC

Notes: *lnREV* is the dependent variable in the equilibrium test. *REV* = ratio of bank total revenue to total assets; *PF* = ratio of annual interest expenses to total borrowing funds (unit price of funds); *POI* = ratio of annual non-interest expenses to total fixed assets (unit price of other inputs); *RISKASS* = ratio of provisions to total assets; *ASSET* = total assets; *GROWTH* = real GDP growth rate. *ln*: natural logarithm; *H*: *H*-statistic; *C*: competitive condition; MC: monopolistic competition; PC: perfect competition; *UN*: undetermined due to the long-run disequilibrium being identified in cases of perfect competition. *lnGROWTH* is dropped in the year-by-year estimation. The *t*-statistics are in parentheses. ***, **, and * indicate a significant difference from zero at 1%, 5%, and 10%, respectively. *a* means that the *H* value is different from zero at a 5% level of significance using the Wald *F* test, i.e., the null hypothesis $H = 0$ is rejected at a 5% level of significance. *b* means that the *H* value is different from one at a 5% level of significance using the Wald *F* test, i.e., the null hypothesis $H = 1$ is rejected at a 5% level of significance.

However, the year-by-year estimations of total revenue (*lnREV*) and interest revenue (*lnINTREV*) models also yield some different but interesting results. Table 6 (*lnREV*) shows that China's commercial banking market was perfectly competitive in the year 2001 but featured monopolistic competition thereafter until 2006. This finding provides support for Yuan (2006)'s argument that the Chinese banking system was near a state of perfect competition before its WTO accession, and that the fulfilment of its WTO commitments might not promote further competition in China's banking.[22]

Table 7 (*lnINTREV*) shows that China's banking market operated in an environment of monopolistic competition in 2001 and one of perfect competition in 2006. Such variations indicate that the competitive conditions between core banking (i.e., bank lending) and non-core banking markets are quite different. It seems that competition in banking intensified after China joined the WTO in 2001, if banking performance is measured with respect to the banks' core business. However, if non-interest income is considered in the assessment, then banking competition has worsened in the later stage, especially after 2004.[23]

Matthews et al. (2007) argued that the reason that competition intensified in some products but worsened in others might be related to the mechanism of "bundling" indicated by Llewellyn (2005). In this mechanism, bank customers may have to purchase a bundle of products because the purchase of one bank product may be conditional on the purchase of another, as required by the bank. This may prevent the bank's customers from searching for the best individual product. Therefore, the lack of competition in the non-core market might suggest that Chinese commercial banks have focused on developing capital-free products to raise their returns and securitisation when they could not reach the target return.[24] As indicated by Llewellyn (2005), this is a typical Economic Value Added business strategy that maximises shareholder value.

In order to investigate such these differences in detail, Figure I is produced to illustrate year-by-year differences in the competitive positions of the two types of bank services. Competitive conditions were very similar for the period 1997-2000. This finding could be explained by the fact that given the strict restrictions imposed on the foreign banks during this period, the competition in China's banking market was mainly concentrated among domestic banks, whose major source of revenue was lending interest. In addition, banks were very reluctant to grant loans to their customers because of the substantial negative influence of the 1997 Asian financial crisis on China's economy, together with the fact that the interest rates in China were liberalised to a very limited extent at this initial stage of deregulation. Therefore, it is not surprising to see a downward trend in the *H*-statistics during this period. Over the period 2001-2003, the competition of the non-core bank business greatly "outperformed" that of the core business. One possible reason is that the domestic

[22] Yuan (2006) found that the banking market in China was in a state of perfect competition in 1997, 1999, and 2000, a result different from that of this study. There are two major reasons for such a difference. First, Yuan (2006) only included 14 major banks in the study sample, while this study has 76 banks in total. Second, Yuan (2006) used a different method to measure input prices. In Yuan (2006), all input prices were defined as the ratios of relevant expenses over total assets. However, the price of funds is conventionally defined as the ratio of interest expenses to total borrowing funds; the price of labor equals the ratio of personnel expenses to the number of employees, and the price of physical capital is measured by the ratio of capital expenses per dollar of fixed assets. This study follows the same or a similar approach to measure input prices.

[23] Matthews et al. (2007) also found that competition seems to have become less intense in the non-core business of British banks over the period 1980-2004.

[24] For example, the Industrial and Commercial Bank of China (ICBC, the largest bank in China) offers a product named the "Settlement Financial Service Package for Small and Medium Enterprises" in order to promote their newly developed cash management and corporate finance services. ICBC's basic settlement products are designed to provide customers with quick, safe and simple options for the transfer of money through its business offices and E-banking. However, its settlement financial service package for SME is a distinctly comprehensive settlement service particularly designed for small- and medium-sized enterprises that covers the basic settlement products and some newly developed cash management and corporate finance products. The package is widely applicable, including complimentary catering of packages to new startups, classical packages for well-established customers who are planning to use ICBC's settlement services, and luxurious packages for customers with settlement accounts who have simple cash management needs. In addition, there are price reductions for all packages: complimentary packages for RMB 380 (original price: RMB 965), classical packages for RMB 580 (original price: RMB 1200), and luxurious packages for RMB 1580 (original price: RMB 4400).(Source: http://www.icbc.com.cn)

banks adjusted their business strategies by putting more of an emphasis on developing and promoting off-balance-sheet activities in order to compete with the gradually deregulated foreign banks. Banks expanded into new, non-traditional areas such as agent services, which primarily include collecting and paying household bills on a customer's behalf and acting as an agent for securities and insurance firms (Shi, 2001).[25]

Table 7
Tests of competitive conditions-dependent variable *lnINTREV*

Period	*intercept*	*lnPF*	*lnPOI*	*lnRISKASS*	*lnASSET*	*lnGROWTH*	R^2	*H*	*C*
1997-2006									
Coef.	0.045***	0.880***	0.004*	0.010	-0.0070***	0.442***	0.901	0.883[a,b]	MC
1997-2001									
Coef.	0.086***	0.870***	0.003	-0.004	-0.0090***	0.255***	0.955	0.873[a,b]	MC
2002-2006									
Coef.	0.019	0.760***	0.004	0.020	-0.0060***	0.622***	0.692	0.764[a,b]	MC
1997									
Coef.	0.036***	0.883***	-0.002	-0.037	-0.0010		0.956	0.881[a,b]	MC
1998									
Coef.	0.022***	0.810***	0.007	-0.031	0.0001		0.576	0.817[a]	UN
1999									
Coef.	0.027***	0.622***	-0.003	0.022*	-0.00002		0.757	0.619[a,b]	MC
2000									
Coef.	0.020***	0.752***	0.001	0.003	0.0000		0.713	0.753[a,b]	MC
2001									
Coef.	0.020***	0.726***	-0.001	0.001	0.0000		0.775	0.726[a,b]	MC
2002									
Coef.	0.026***	0.539***	-0.004	-0.015	-0.0002		0.394	0.534[a,b]	MC
2003									
Coef.	0.018***	0.635***	0.001	-0.028***	0.0003		0.610	0.636[a,b]	MC
2004									
Coef.	0.024***	0.780***	0.001	0.017	-0.0001		0.704	0.781[a,b]	MC
2005									
Coef.	0.024***	0.780***	0.001	0.017	-0.0001		0.792	0.781[a,b]	MC
2006									
Coef.	0.022***	0.932***	-0.001	0.014	0.0000		0.703	0.931[a]	PC

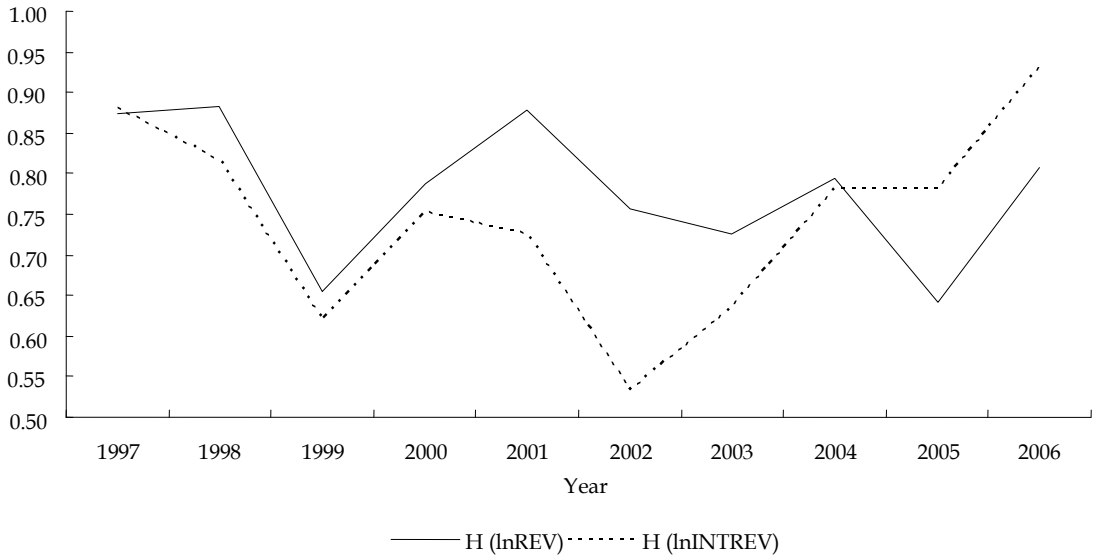
Notes: *lnINTREV* is the dependent variable in the competitive condition test. *lnINTREV* = ratio of bank interest revenue to total assets; *PF* = ratio of annual interest expenses to total borrowing funds (unit price of funds); *POI* = ratio of annual non-interest expenses to total fixed assets (unit price of other inputs); *RISKASS* = ratio of provisions to total assets; *ASSET* = total assets; *GROWTH* = real GDP growth rate. *ln*: natural logarithm; *H*: *H*-statistic; *C*: competitive condition; MC: monopolistic competition; PC: perfect competition; *UN*: undetermined due to the long-run disequilibrium being identified in the case of perfect competition. *lnGROWTH* is dropped in the year-by-year estimation. The *t*-statistics are in parentheses. ***, **, and * indicate a significant difference from zero at 1%, 5%, and 10%, respectively. *a* means that the *H* value is different from zero at a 5% level of significance using the Wald *F* test, i.e., the null hypothesis $H = 0$ is rejected at a 5% level of significance. *b* means that the *H* value is different from one at a 5% level of significance using the Wald *F* test, i.e., the null hypothesis $H = 1$ is rejected at a 5% level of significance.

The ratio of non-interest income to the total revenue of the sample banks jumped from 6.4% in 2000 to 9.5% in 2003. Such a large change shows that banks in China adjusted their sources of income by fighting for non-interest earnings during that period.

[25] For example, banks formed affiliations with securities firms and introduced a telephone bank-broking business that clients could use to buy or sell stock using their deposits accounts. Any earnings from shares are returned to the account.

Competition with respect to core banking services increased substantially and continuously from 2002 to 2006 and was fiercer than competition in the non-core banking services in 2005 and 2006.

Figure I
H-statistics: lnREV vs. lnINTREV



Notes: *lnREV* = ratio of total revenue to total assets; *lnINTREV* = ratio of interest revenue to total assets.

This trend is partly contributed to by the accelerated interest rate reform announced by the State Council in 2002. During this period, both foreign currency lending and deposit rates were largely liberalised. The ceiling on the RMB lending rate was removed, while the floor of the RMB lending rate was 90% of the benchmark rate. In addition, the interest rate on long-term (>5 years), large-value (>30 million) RMB deposits was liberalised, and there was no restriction on the minimum RMB deposit rate charged by the banks. Finally, the inter-bank interest rate was liberalised. Therefore, banks were equipped with enhanced capability in terms of pricing of their products, which might have intensified competition in the market for core banking business. On the other hand, the increased participation of the deregulated foreign banks has led to greater challenges to the domestic banks since WTO accession. To cope with such challenges, the domestic banks, including the state banks, national joint-stocks, and city and rural commercial banks, undertook a series of reforms to improve their efficiency and productivity.[26] The market finally achieved perfect competition in 2006, when all restrictions imposed on foreign banks were removed.

6. Conclusions

This study estimates the competitive conditions of China's commercial banking sector during a period of major structural change. In particular, estimates of the Rosse-Panzar *H*-statistic are presented for a panel of 76 banks over the period 1997-2006. The long time period and larger sample set used in this study represent areas of difference from previous studies. The results suggest that the Chinese commercial banking market is monopolistic-competitive in general. However, the disaggregated picture of competitive conditions shows that competition in banking intensified after China joined the WTO in 2001, if banking performance is measured with respect to its core business. Nevertheless, if non-interest income is considered in the assessment, then it is clear that banking competition decreased during the later stage. Specifically, the lending market was monopolistic-competitive in 2001 but perfect-competitive in 2006, the year China's banking market

[26] For details, please see Fu and Heffernan (2007, 2008, 2009).

was fully opened up to the foreign competitors. In contrast, the banking market was perfect-competitive in 2001 (the year China joined the WTO) and monopolistic-competitive in 2006 if the non-core banking activities are considered. Such differences can be explained by the mechanism of "bundling" proposed by Llewellyn (2005), as well as the massive banking reforms in China over the sample period. These include interest rate liberalisation, the WTO commitment to fully opening up the banking sector, the joint-stock reform of the Big Four, foreign equity investment in domestic banks, bank listing, and the creation of rural commercial banks. The implications for policy suggest that further banking reforms are needed to improve competitive conditions in China's commercial banking market. First, interest rate deregulation should be accelerated to enable the banks to use more flexible approaches to managing their assets and liabilities and covering their risk exposures. Second, reforms made to increase the presence of foreign banks should be continued in order to stimulate more competition in the non-core banking services. Finally, a stronger focus should be placed on transparency with regard to bank charges and fees; this, in turn, might reduce consumer inertia arising from the "bundling" of bank services. Overall, China's commercial banking industry has some distance to travel in developing a structure through which to tackle the challenges of global banking competition.

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